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# BULLETIN

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# Contents of Volume III.

Title-page ..... i.
Contents ..... iii.
List of Illustrations ..... iv.
Dates of publication of Author's Separates ..... v.

PAGE

Art. I.—The Calciferous Formation in the Champlain Valley. By Ezra Brainerd and H. M. Seely, of Middlebury College ..... 1

II.—Observations on the Fauna of the Rocks at Fort Cassin, Vermont, with Descriptions of a few New Species. By R. P. Whitfield. (Plates I–III.) ..... 25

III.—On Seasonal Variations in Color in *Sciurus hudsonius*. By J. A. Allen ..... 41

IV.—A Review of Some of the North American Ground Squirrels of the Genus *Tamias*. By J. A. Allen ..... 45

V.—Observations on a Fossil Fish from the Eocene Beds of Wyoming. By R. P. Whitfield ..... 117

VI.—Description of a New Genus of Inarticulate Brachiopodous Shell. By R. P. Whitfield. (Plate IV.) ..... 121

VII.—On a Collection of Birds made by Mr. Clark P. Streator in British Columbia, with Field Notes by the Collector. By Frank M. Chapman ..... 123

VIII.—Descriptions of a New Species and a New Subspecies of *Lepus*. By J. A. Allen ..... 159

IX.—List of Mammals collected by Mr. Clark P. Streator in British Columbia, with Descriptions of two New Subspecies of *Sciurus*. By J. A. Allen ..... 161

X.—Notes on a Small Collection of West Indian Bats, with Description of an apparently New Species. By J. A. Allen ..... 169

XI.—Notes on Collections of Mammals made in Central and Southern Mexico, by Dr. Audley C. Buller, with Descriptions of New Species of the Genera *Vespertilio*, *Sciurus*, and *Lepus*. By J. A. Allen ..... 175

PAGE

XII.—Description of a New Species of Big-eared Bat, of the Genus *Histiotus*, from Southern California. By J. A. ALLEN..... 195

XIII.—Further Notes on Maximilian Types of South American Birds. By J. A. ALLEN..... 199

XIV.—Notes on a Collection of Mammals from Costa Rica. By J. A. ALLEN..... 203

XV.—On a Collection of Mammals from Southern Texas and North-eastern Mexico. By J. A. ALLEN..... 219

XVI.—Description of a New Subspecies of the Eastern Chipmunk, from the Upper Mississippi Region, West of the Great Lakes. By EDGAR A. MEARNS, Assistant Surgeon, U. S. A..... 229

XVII.—Description of a New Species of Weasel, and a New Subspecies of the Gray Fox, from Arizona. By EDGAR A. MEARNS, Assistant Surgeon, U. S. A..... 234

XVIII.—Observations on the North American Badgers, with Especial Reference to the Forms found in Arizona, with Description of a New Subspecies from Northern California. By EDGAR A. MEARNS, Assistant Surgeon, U. S. A..... 239

XIX.—Notes on the Otter (*Lutra canadensis*) and Skunks (Genera *Spilogale* and *Mephitis*) of Arizona. By EDGAR A. MEARNS, Assistant Surgeon, U. S. A..... 252

XX.—Notes on New or Little-known North American Mammals, based on recent additions to the Collection of Mammals in the American Museum of Natural History. By J. A. ALLEN.... 263

XXI.—On the Color-Pattern of the Upper Tail-Coverts in *Colaptes auratus*. By FRANK M. CHAPMAN..... 311

XXII.—On the Birds observed near Corpus Christi, Texas, during parts of March and April, 1891. By FRANK M. CHAPMAN..... 315

XXIII.—Description of a New Species of *Capromys*, from the Plana Keys, Bahamas. By J. A. ALLEN..... 329

XXIV.—On a Collection of Birds from Chapada, Matto Grosso, Brazil, made by Mr. Herbert H. Smith. By J. A. ALLEN. (Part I. —Oscines.)..... 337

XXV.—Observations on some Cretaceous Fossils from the Beyrût District, Syria, in the Collection of the American Museum of Natural History, with Descriptions of some New Species. By R. P. WHITFIELD. (Plates IV A, V–XI)..... 381

# LIST OF ILLUSTRATIONS.

## *Cuts.*

Maps and Sections, illustrating the Calciferous Formation in the Champlain Valley:

PAGE

Map No. 1, East Shoreham, Vt. . . . . 5
" 2, Fort Ticonderoga and vicinity. . . . . 11
" 3, West Charlotte, Vt. . . . . 15
" 4, Providence Island and vicinity. . . . . 18
" 5, Providence Island, Lake Champlain. . . . . 21
Sections 1–6. . . . . 8
" 7–8. . . . . 19
Section at Fort Cassin, Vt. . . . . 26
Diagram of relationships and lines of probable intergradation of some of the North American species of Ground Squirrels. . . . . 63
Illustrations of *Lingulodiscina exilis*. . . . . 122
Illustrations of cranial variation in species of *Dipodomys* and *Dipodops*. . . . 280
Illustrations of color-pattern in the upper tail-coverts of *Colaptes auratus*. . 314
Skull and dentition of *Capromys ingrahami* and *C. brachyurus thoracatus*, 335
Hinge area in *Platopis undata* and *P. obruta*. . . . . 400

## *Plates.*

Plates I–III.—Fort Cassin Fossils.
Plate IV.—Eocene Fossil Fish (*Notogoneus osculus?*).
" IV A, and V–XI.—Syrian Fossils.
(Each plate is faced by an explanatory leaf.)

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ARTICLE I.—*The Calciferous Formation in the Champlain Valley.* By EZRA BRAINERD and H. M. SEELY, of Middlebury College.

The term Calciferous was used by the older geologists of New York and Vermont to designate the strata between the Potsdam sandstone and the Chazy limestone. The lower boundary is well defined, as the Potsdam sandstone has been long recognized and carries a peculiar fauna. The upper boundary, the base of the Chazy, is less definite; but we consider it to be certain strata of sandstone, from thirty to forty feet in thickness, described in the *Geology of Canada*, 1863 (p. 123), and found in the Champlain region in several localities below all other beds containing characteristic Chazy fossils.

In our study of the rocks of the Champlain Valley we have been surprised at the development of the Calciferous formation—at its vast thickness, its variety of rock, and its abundant fauna. That the earlier geologists, who made explorations on this ground, Professors Emmons, Adams, and Hitchcock, should have made such brief mention of this grand sub-division must be attributed to the fact that they had wide areas to examine, and but brief time allotted them. The Calciferous is, moreover, a most difficult formation to decipher, because of its great thickness, the absence of fossils in most exposures, and the resemblance to each other of its various beds of magnesian limestone.

In our study of these rocks every important exposure has been visited on the Vermont side of Lake Champlain from Philipsburgh to Benson, and most of those on the New York side. Instead of a thickness of 300 feet for the Calciferous, as estimated in the Vermont Report, we find a thickness of 1800 feet; instead of the four or five species of fossils there mentioned we find over a hundred species, many of which are as yet undescribed.

There are two localities in which the entire sequence of Calciferous strata can be seen. One of these is in Eastern Shoreham, and was first discovered by Rev. Augustus Wing, and referred to by him as "the Bascom ledge" (see Am. Jour. of Science, 1877, Vol. XIII, p. 343). It is a great monocline two miles in width and three to five miles in length, in which all the Lower Silurian

rocks are seen overlying at least 200 feet of Potsdam sandstone (Map No. 1). The strike is somewhat sinuous, and the dip varies from 9° E. to 38° E., but there are no abrupt changes in either except at the northern or western borders. Much of the rock is covered with soil, but exposures on hillsides, along water-courses, and in escarpments of cliffs are sufficient to reveal the character and thickness of all the members of the Calciferous formation. The section herewith presented (No. 1, p. 8) begins about a mile north of Richville, and runs S. 67° W. by the house of Mr. L. Webster. The list of fossils will be given farther on.

The strata of the Calciferous seen at various exposures in this monocline are as follows, in ascending order:

### Division A.

Dark iron-grey magnesian limestone, usually in beds one or two feet in thickness, more or less silicious, in some beds even approaching a sandstone. Nodules of white quartz are frequently seen in the upper layers, and near the top large irregular masses of impure black chert, which, when the calcareous matter is dissolved out by long exposure, often appears fibrous or scoriaceous. Thickness..... 310 ft.

### Division B.

Dove-colored limestone, intermingled with light grey dolomite, in massive beds; sometimes for a thickness of twelve or fifteen feet no planes of stratification are discernible. In the lower beds, and in those just above the middle, the dolomite predominates; the middle and upper beds are nearly pure limestone; other beds show on their weathered surfaces, raised reticulating lines of grey dolomite. Thickness..... 295 ft.

### Division C.

1. Grey, thin-bedded, fine-grained, calciferous sandstone, on the edges often weathering in fine lines, forty or fifty to the inch, and resembling close-grained wood. Weathered fragments are frequently riddled with small holes, called *Scolithus minutus* by Mr. Wing..... 60 ft.
2. Magnesian limestone in thick beds, weathering drab..... 100 ft.
3. Sandstones, sometimes pure and firm, but usually calciferous or dolomitic..... 70 ft.
4. Magnesian limestone like No. 2, frequently containing patches of black chert.....120 ft.

Thickness of "C"..... 350 ft.

### Division D.

1. Blue limestone in beds one or two feet thick, breaking with a flinty fracture; often with considerable dolomitic matter intermixed, giving the weathered surface a rough, curdled appearance; becoming more and more interstratified with calciferous sandstone in thin layers, which frequently weathers to a friable, ochreous rotten-stone.... 80 ft.
2. Drab and brown magnesian limestone, containing also toward the middle several beds of tough sandstone..... 75 ft.
3. Sandy limestone in thin beds, weathering on the edges in horizontal ridges one or two inches apart, giving to the escarpments a peculiar banded appearance. A few thin beds of pure limestone are interstratified with the silicious limestone..... 120 ft.
4. Blue limestone in thin beds, separated from each other by very thin, tough, slaty layers, which protrude on the weathered edges in undulating lines. The limestone often appears to be a conglomerate, the small enclosed pebbles being somewhat angular and arenaceous, 100 ft.

Total thickness of "D"..... 375 ft.

### Division E.

Fine-grained magnesian limestone in beds one or two feet in thickness, weathering drab, yellowish or brown. Occasionally pure limestone layers occur, which are fossiliferous, and rarely thin layers of slate. Thickness..... 470 ft.

Total thickness..... 1,800 ft.

### Section northeast of Shoreham Village.

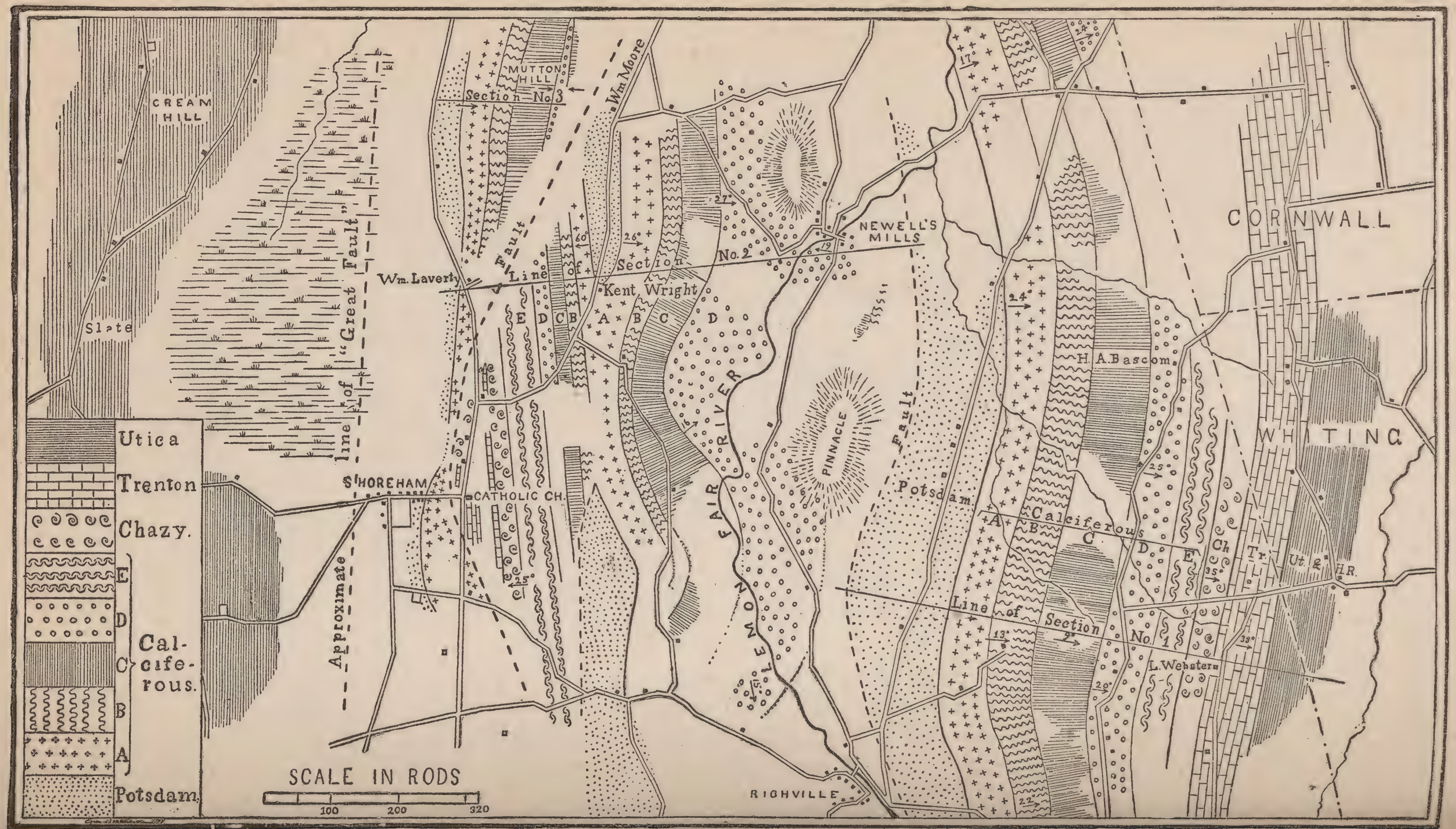
The other uplift, where all the strata of the Calciferous are to be seen, occurs in the tract extending from Shoreham Village, about two miles northeast to Newell's Mills. It consists of an anticline with an almost vertical dip on the western side, and a dip of 26° or less on the eastern side. (See Map No. 1 and Section 2.) The lowest strata brought up on the axis are the grey sandstones and the ferruginous dolomites of the Potsdam seen on both sides of the highway between Mr. William Moore's and Mr. Kent Wright's. These are flanked on either side by Division A of the Calciferous, the two branches uniting south of Mr. Wright's, as the axis of the anticline descends toward the south. A mile farther south the Potsdam sandstone reappears on the axis with a dislocation on the western side. Division A is succeeded on

the east by Divisions B, C and D in order, appearing for two miles north and south with a somewhat sinuous strike. The dip in the strata of D becomes gradually less and less, until they lie in a shallow syncline near the river, and finally terminate on the east with an abrupt westerly dip, which may be seen near the bridge at Newell's Mills and in a south spur of the hill known as "the Pinnacle." East of this line may be seen various members of the Calciferous group in a highly-disturbed condition, until the Potsdam sandstones are reached, which form the western borders of the great monocline already described.

On the west side of the anticline the upturned edges of all the members of the Calciferous are well exposed in the pastures lying southwest of Mr. Wright's. The strata of Division E, at first vertical, become gradually inclined to the west 30° or 40°, and are succeeded by the massive beds of the Chazy containing *Maclurea magna*, lying in a narrow syncline, and holding in the axis of the trough the Black River limestones with characteristic fossils. Half a mile farther south the trough becomes broader, and at the Catholic Church the Trenton appears on the axis flanked on either side by the Black River and the Chazy in succession.

But directly west of the Chazy, on the west side of the highway, appear strata of the lowest Calciferous, dipping eastward and overlying the Potsdam. This uplift may be traced northward in nearly a straight line for three miles, until we reach the west slope of Mutton Hill. This hill rises 250 feet above the road, as indicated by the aneroid, and consists of the Potsdam on the west dipping 16° to 37° E., overlaid by Divisions A, B, and C of the Calciferous (see Section No. 3). On the eastern side of the hill the strata suddenly assumes a western dip, and in the narrow syncline may be seen the lower subdivision of D—strata holding *Ophileta complanata* Vanux.

On the west of this uplift of the Potsdam is a great swamp, succeeded on the south by a deep valley just west of Shoreham Village. West of the swamp and the valley appears a line of slate hills extending north and south for at least ten miles. Somewhere along the valley and the swamp appears to have been the line of "the great break," or overthrust running northward into Canada.




MAP NO. 1, EAST SHOREHAM, VT.

To understand the stratigraphy of the Shoreham anticline we may suppose: first, the occurrence a mile or two east of the great break, of a second fold, forming a syncline with a steep westerly dip on its east side and a companion anticline; second, a fracture through the fold in a plane sloping about 20° to the southeast; third, a westward shove for several thousand feet of the rocks above the fracture, bringing the Chazy and Black River rocks of the original syncline close to the Potsdam and Lower Calciferous. Mutton Hill would thus be a remnant of the original syncline, lying below the plane of fracture.

Section No. 2 represents the succession of strata between Mr. Laverty's and Newell's Mill, excepting that the Chazy and Black River are introduced as they appear on the strike about a hundred rods south. The Calciferous strata are substantially the same in thickness and lithological character as in the section already described. Indeed it may be said that all through the towns bordering on Lake Champlain the various members of the Calciferous are remarkably persistent, and vary but little in character even when found near the Archæan terranes. The upper strata of Division D, however, are lacking west and north of Shoreham, but are thicker to the east; while the strata of Division E to the east rapidly becomes thinner; and at a very good exposure of the upper Calciferous, two miles west of Middlebury, they appear to be wanting altogether.

Our attention the past summer has been given rather to stratigraphy than to the collection of fossils, but in this preliminary work we have found in the Calciferous of Shoreham the following species and genera:

Division A.—None.

Division B.—Orthoceras primigenium, Vanux.
Holopea (undetermined species).
Cryptozoön Steeli (new species, hemispherical, 6 to 20 inches in diameter; banded from the centre outward like agate, and with a tinge of purple).

Division C.—None, except *Scolithus minutus* of Wing.

Division D.—Ophileta complanata, Vanux.*
Maclurea affinis, Vanux.

* Note.—It is to be remembered that this typical Calciferous species is not found associated in the same beds with the Fort Cassin fossils, but only in the basal portion of the 375 feet.—R. P. W.

Lituites Eatoni, Whitf.
Asaphus canalis, Conrad.

Also, undetermined or undescribed species of

| | |
|---|---|
| Cryptozoon, Hall. | Murchisonia. |
| Bathyurus (2 species). | Orthoceras. |
| Maclurea. | Crytoceras. |

DIVISION E.—Bucania tripla, Whitf.
Murchisonia confusa, Whitf.
Bathyurus extans, Hall, var.?
Primitia Seelyi, Whitf.

Also undescribed species of

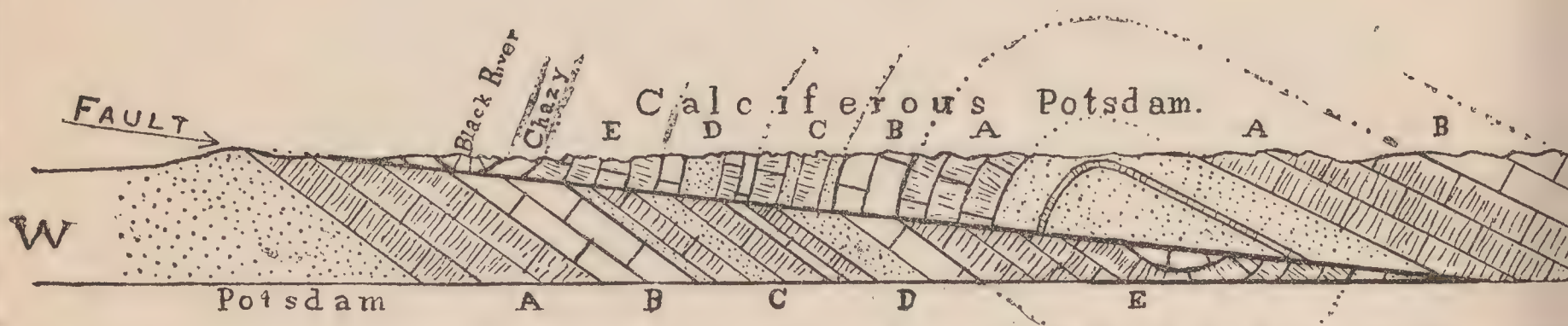
| | |
|---|---|
| Lingula. | Bathyurus. |
| Maclurea? | Cheirurus? |
| Murchisonia. | And encrinal columns. |
| Orthoceras. | |

## ORWELL SECTION.

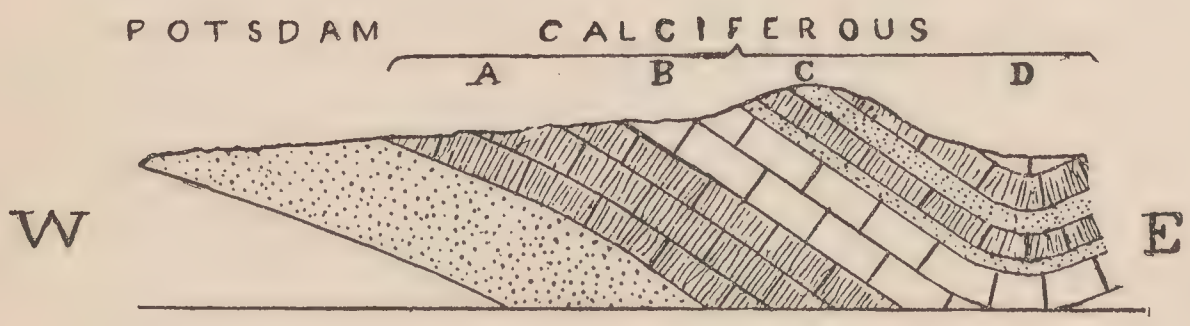
In the town of Orwell, which lies directly south of Shoreham, the upper members of the Calciferous are brought up in an anticline. The accompanying section (No. 4) was measured about a mile northwest of the village. The limestone at the base of Division D, with *Ophileta complanata*, Vanux., appears on the axis of the anticline, succeeded on either side by the magnesian limestone, the banded sandstone and the conglomerate limestone of this division. Above these on the west, with an ever increasing dip, appear the drab limestones of Division E; then the Chazy, with *Maclurea magna;* then the Black River. Westward still are seen at intervals, in the ravines, the strata of the Trenton tilted beyond the vertical; and finally the Utica slate; all with characteristic fossils.

One mile farther north, in the bed of a stream called "the North Branch," the anticline is farther abraded so as to disclose all but the lowest strata of Division C. At this locality the slate appears on the west not 35 rods from the axis; an insufficient space for the rocks that would normally intervene. One hundred and fifty rods south of the section the anticline is broken by transverse faults, and at the brink of a high cliff, one hundred rods north of Chittenden's Mills, the Chazy is seen with an overturn dip of 41° E. overlying the Black River. As this is along the line of the "great break," it is surmised that the anticline has been shoved for some distance over the slate, and probably along a plane that would fall within the range of the figured section.

No. 1. SOUTHEA




No. 2 NORTHEAST O

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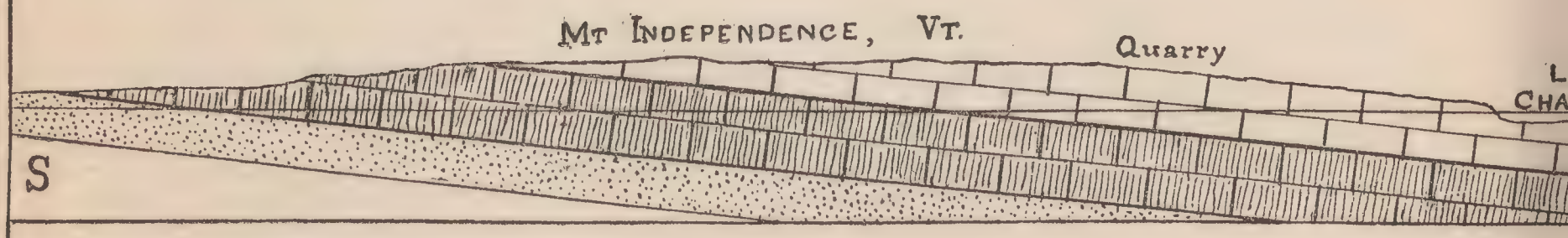
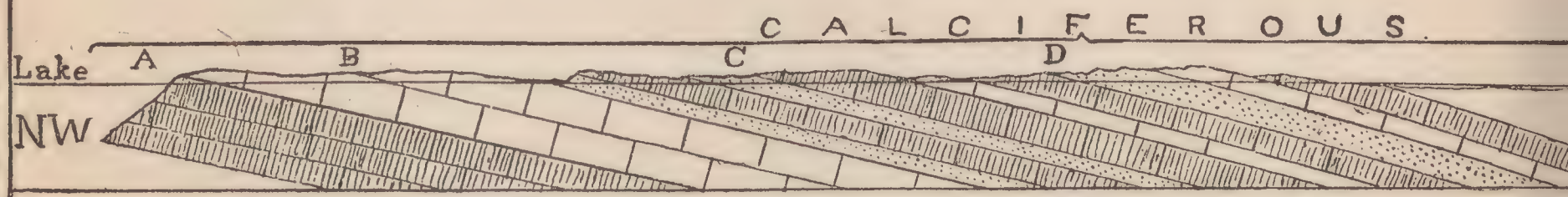



POTSDAM

No. 5. MT. INDEPENDEN

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Ezra Brannock Del

SECTIONS ILLUSTRATING THE CAL

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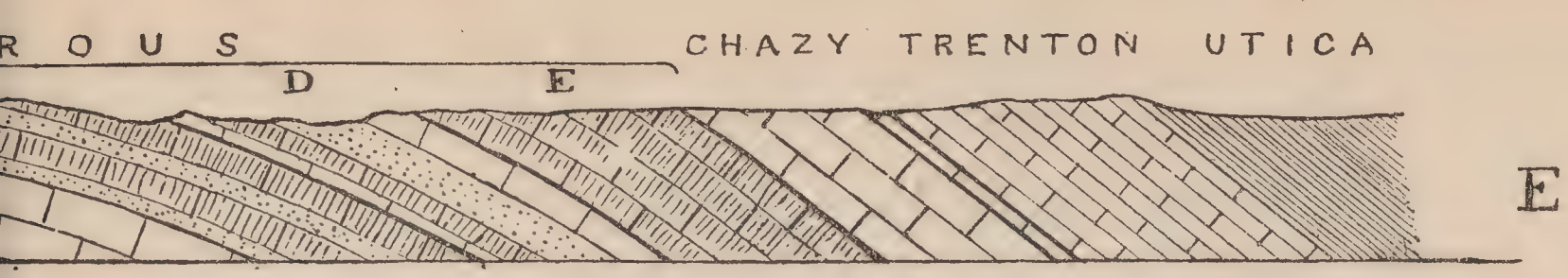
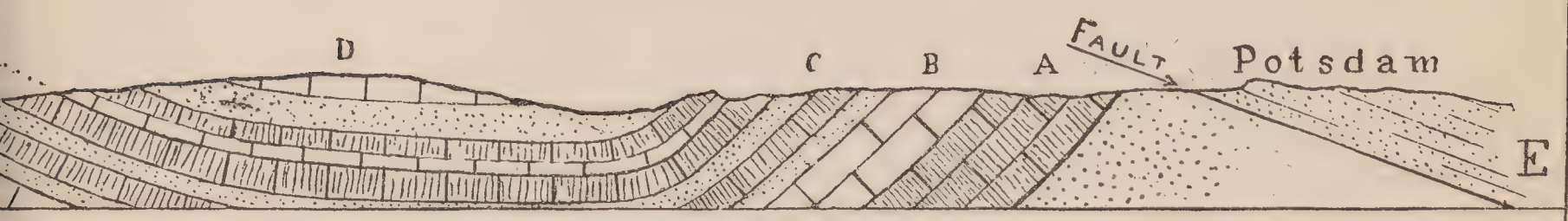
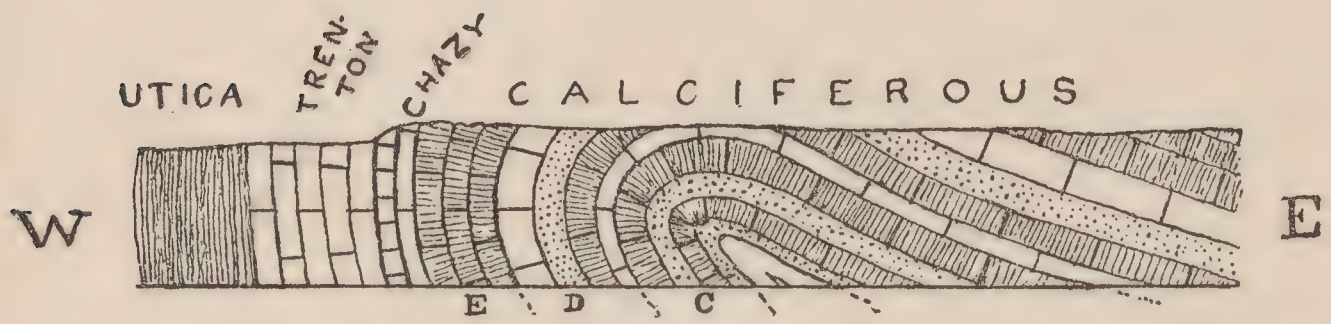


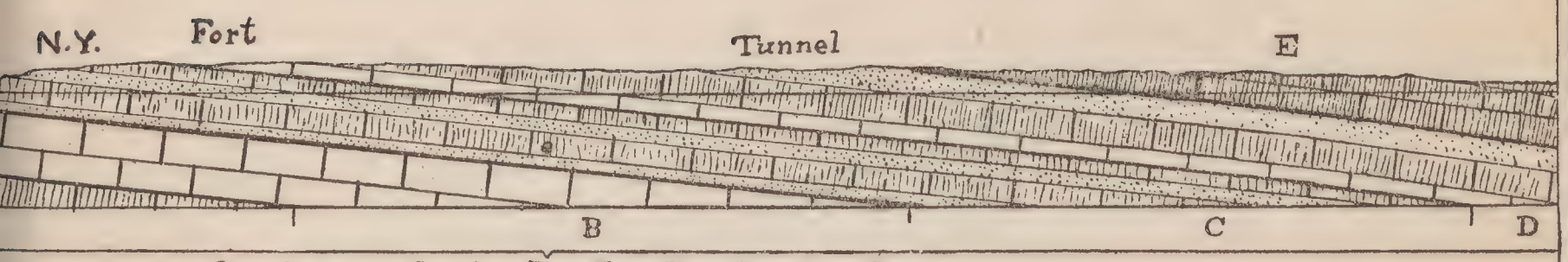

HOREHAM, VT.




HOREHAM VILLAGE.




No 4. ORWELL, VT.



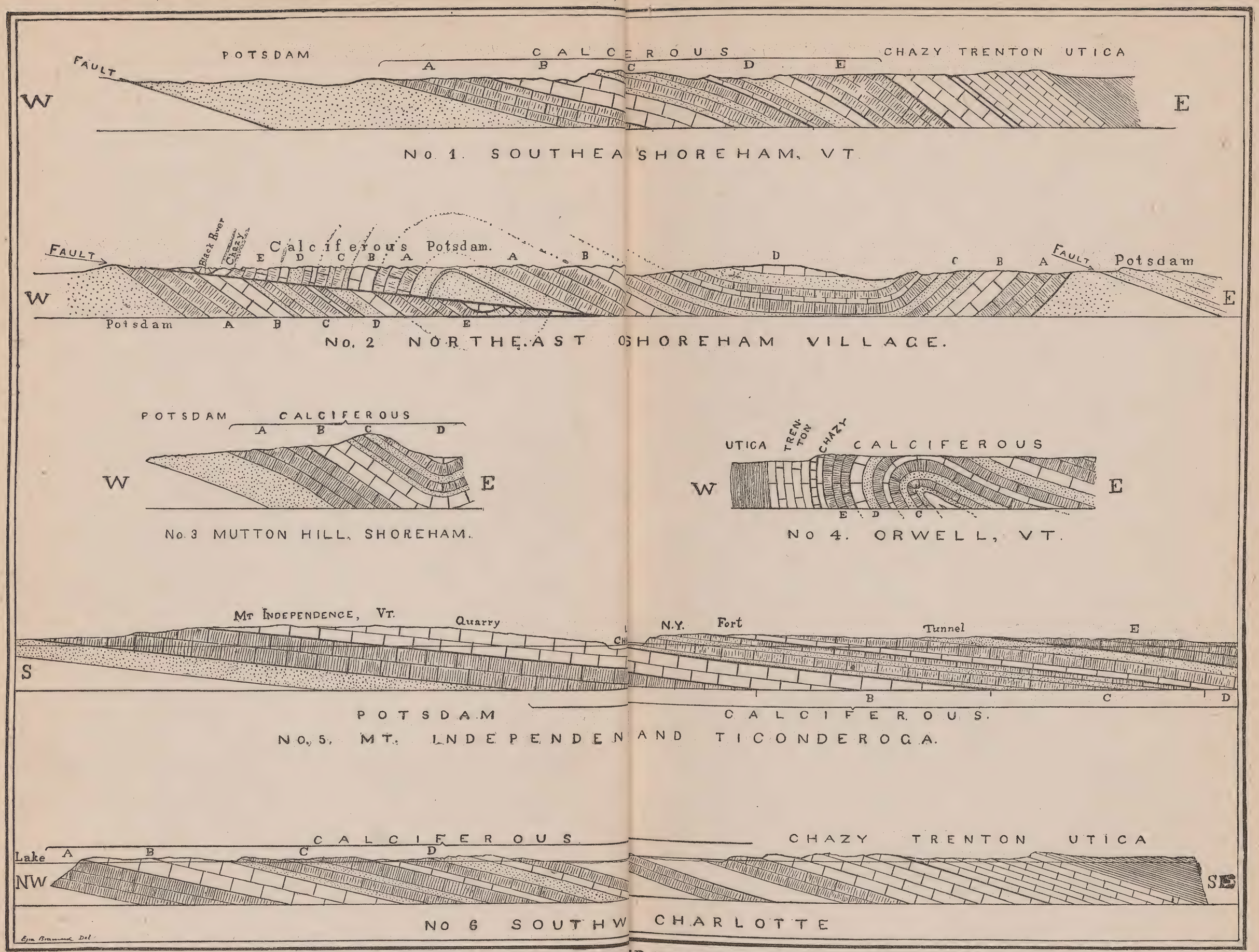

CALCIFEROUS.

ND TICONDEROGA.

CHARLOTTE

OUS OF THE CHAMPLAIN VALLEY

500 1000 2000




SECTIONS ILLUSTRATING THE CAL ROUS OF THE CHAMPLAIN VALLEY

Vertical & horizontal scale: 500 1000 2000 feet.

## Fort Ticonderoga Section.

In the northwest corner of Orwell, three and a quarter miles from Section 4, and five miles southwest of Shoreham village, is a hill known as Mount Independence. It rises nearly 200 feet above Lake Champlain, and is about a mile in length, the top along the north half being a smooth plane sloping gently to the north. This plateau was the old parade ground of the soldiers of Fort Ticonderoga, which stood across the lake only half a mile to the north. In fact the promontory on which the fort was built is but the continuation of Mount Independence, after an interval of eighty-eight rods of water, and extends for over a mile further northwest.

This whole tract of historic ground consists of Calciferous strata over 1300 feet in thickness, dipping north at an angle of 6°, and overlying 170 feet of Potsdam sandstone. Map No. 2 and Section No. 5 show the thickness and location of the various beds that appear through a distance of two miles and a half. The plateau on the north end of Mount Independence is the top of Division B, the thin-bedded sandstone at the base of Division C having been removed by glacial action, not only here, but farther north, where is now the channel of the lake. The upper layers of B are largely quarried and used for flux in the iron-furnaces. On the New York side in a steep cliff at the end of the promontory appear the remaining beds of C—magnesian limestone interstratified with sandstone. The ruins of the Fort, 100 feet above the lake, are on the mottled limestones at the base of D, containing *Ophileta complanata*, Vanux, and a large *Orthoceras*. One hundred yards farther northwest the railroad tunnel is cut through the magnesian limestone (D, 2), and above the tunnel, at the north end, appear the banded sandstones (D, 3). These and the superjacent strata are best seen farther west on the steep southern slope of the promontory. We miss, however, the blue thin-bedded limestones at the top of Division D. At a point forty rods southwest of the forks of the road, there is a sudden change in the dip of the drab limestones of Division E to 23° northeast, and an abrupt curvature in the strike intimating our approach to some point of disturbance. Farther east, north of the main highway, are other exposures of the drab-colored lime-

No. 2 FORT TICONDEROGA AND VICINITY

stone. The fossils observed in these higher limestones of E are: Stenopora fibrosa and several undetermined species of Euomphalus, Lituites, Orthoceras and Cyrtoceras.

Along the east side of Mount Independence and the Fort Ticonderoga promontory are marked indications of a downthrow of the strata on the east. This is finely disclosed at the north end of the railroad tunnel. The appearance of the bent and broken strata, and the deposition of great masses of calcspar indicate a falling away of the rocks on the east rather than a lateral thrust. Farther north near the highway may be seen strata of Black River and Trenton limestone and of Utica slate dipping north at a very high angle and abutting against the Calciferous; while on the opposite side of the lake the same strata appear with a moderate dip, but varying strike directed toward the exposure on the west.

South of the old fort, across the outlet of Lake George, Mount Defiance rises to the height of 750 feet above Lake Champlain, consisting of Archæan norite and limestone. Farther southeast along the New York shore are extensive exposures of the Potsdam sandstone, dipping to the north, as though continuous under the lake with the sandstones seen at the south end of Mount Independence. Going still southward, after crossing a wide marsh, through which the fault east of Mount Independence seems to run, we find at Patterson Station another Archæan ridge protruding into the lake; but this time it is hornblendic gneiss, a far different rock from that of which Mount Defiance is composed.

When we observe this fringe of Potsdam and Calciferous rock around the base of Mount Defiance—extending for over three miles, dipping regularly to the north, and terminating on the east in a fault nearly parallel with the base of the mountain—the thought is forcibly suggested that in the profound disturbance which produced the Green Mountains, the Archæan rock was elevated one or two thousand feet and tilted somewhat to the north, bringing up on its flank the Potsdam and Calciferous into their present position. Several quite similar dislocations have been observed elsewhere along the west side of Lake Champlain. A notable illustration we have described (Am. Geologist, Vol. II,

p. 327) as occurring at Chazy, N. Y., where the Potsdam is seen lying nearly horizontal, but higher than the steeply-inclined Chazy and Trenton limestone a few rods to the east. Sir Wm. Logan's section, at Montmorency Falls (Can. Naturalist and Geologist, Vol. VI, p. 199), is another excellent illustration of this upthrow of the Archæan.

A few words should be said of the exposure to the north of Ticonderoga Village. Potsdam sandstone is seen at the Falls of the outlet of Lake George, which is 240 feet higher than Lake Champlain. The Potsdam sandstone is succeeded on the north by all the members of the Calciferous, dipping 8° or 10° to the north. They form a plateau nearly 200 feet above the lake and about 1½ miles in length, with steep cliffs on the east, along which are signs of an upthrow similar to those already described. To the west the strata are again broken by still another like dislocation, but of less extent.

Another noteworthy feature of this region is the entire absence of all strata of the Chazy group. They seem to be lacking because of non-deposition. At the south end of Larabee's Point there is exposed beneath the Black River about forty feet of drab limestone, and about six feet of compact slate. Though affording no fossils except fucoids, they are totally unlike any Chazy rock that we have seen; but the limestones closely resemble some of the highest strata of the Calciferous seen just across the lake. They are alike in color, in texture, and in the peculiarity of fading, after a few years' exposure, to a light grey, the change in color penetrating about half an inch beneath the surface. The Chazy strata have not been observed anywhere south of this point along Lake Champlain, and, as stated in the New York Reports, are wanting at Glens Falls and in the Mohawk Valley. But as we go north or east of Ticonderoga they gradually make their appearance. In the Orwell section their thickness is only fifty feet. Still farther north additional strata of sandstone and of limestone make their appearance, until a maximum of at least 700 feet is reached.

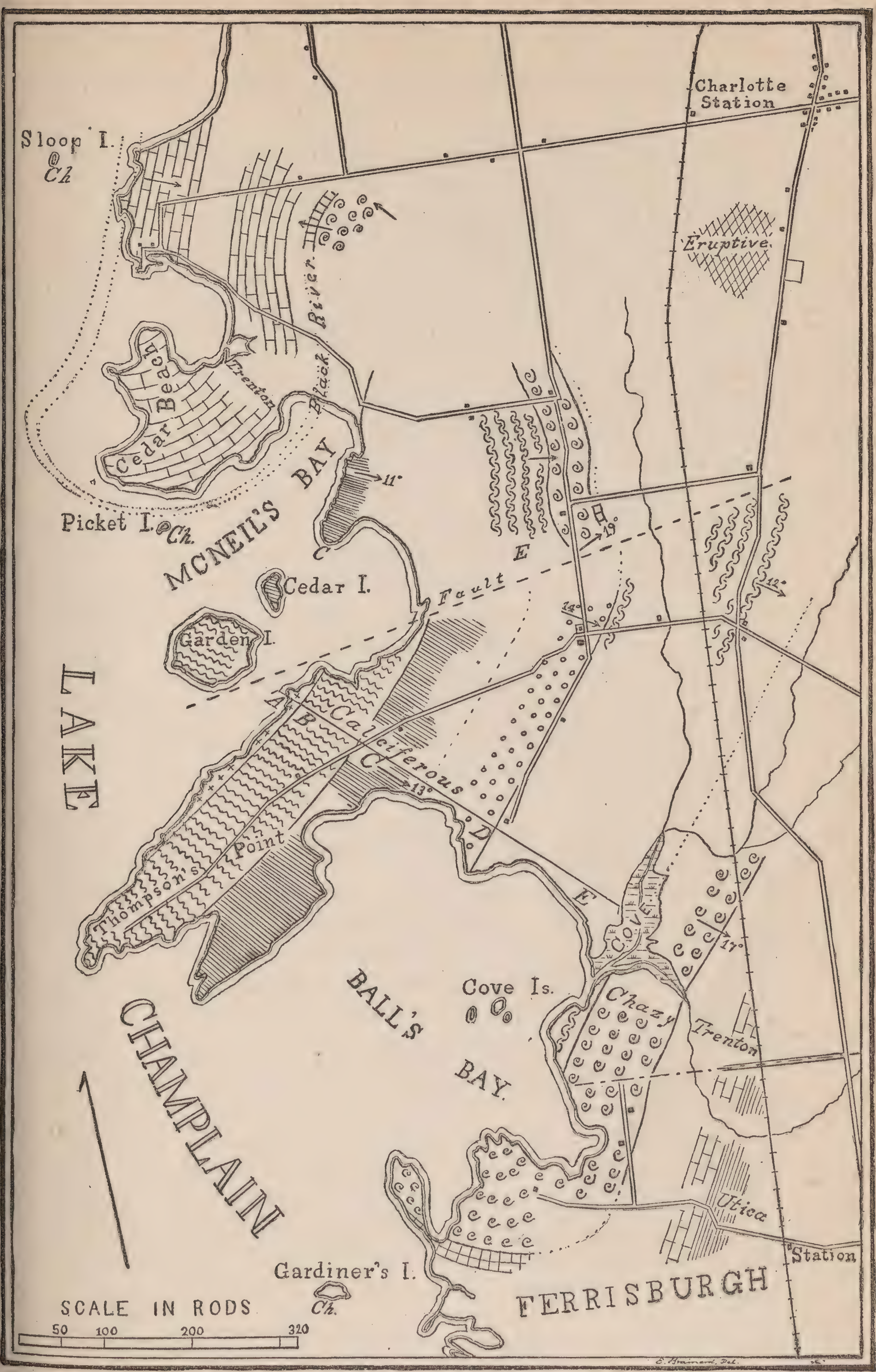
In the Vermont Report, pp. 267–269, certain slates are described as belonging to the Calciferous group. One of these exposures is in the extreme southwest corner of Shoreham, where

the Addison Railroad crosses the lake (see Map No. 2). The dip is N. 30° E., at angle of 12°, so that the slates seem to underlie the Black River limestones seen sixty rods to the north, across a small bay. But the discovery of *Graptolithus pristis*, Hising.; *Calymene Blumenbachii*, Brongt, and other fossils in the slate, proves it to be of the Utica formation; and we must suppose the existence of another fault running through the small bay. Another exposure of slate in the south part of Orwell, supposed to be Calciferous, contains Utica fossils. We have observed no strata of slate of any considerable thickness in the Calciferous rocks of Lake Champlain.

### Section in Southwest Charlotte.

Twenty-eight miles north of Old Fort Ticonderoga, at Thompson's Point, is another remarkable display of nearly all the members of the Lower Silurian. It is another monocline dipping southeast from 12° to 20°, and extending from the north shore of Thompson's Point, 2½ miles across the strike, to the line of the Rutland Railroad. (See Map No. 3 and Section No. 6.) The lowest strata in sight are thirty or forty feet of iron-grey magnesian limestone, containing chert, in beds one or two feet thick, supposed to be the top of Division A. Then appear the light-grey massive dolomites of Division B, forming high cliffs sloping to the south, a favorite resort for summer cottagers. The sandstones at the base of Division C are largely abraded here, as at Mount Independence; the deep bay which bifurcates the Point taking its place. They are to be seen, however, at the head of the bay. The magnesian limestones of Division C occupy the remainder of the Point, the small bay at the south end indicating the position of the upper sandstone beds of this division. Large masses of black chert are displayed on the southeast shore and on the ledges just south of the road. North of the road these ledges continue on to the head of the bay east of Cedar Island, and in the western escarpments are again to be seen the fine-grained sandstones of the base of the division.

The next hundred and fifty feet of rock is concealed by the soil, but is supposed to be the Ophileta limestones and dolomites at base of Division D. After this interval the banded sandstones




No. 3, WEST CHARLOTTE, VT.

and the blue limestones of this division appear with a thickness of 200 feet, in ledges extending a mile northeast to the schoolhouse. The fossils found here are :

Murchisonia obelisca, Whitf.
Maclurea acuminata, Bill.
" affinis, Bill.
Euomphalus, or Oristoma, (n. sp.)
Triplesia lateralis, Whitf.
Holopea Cassina, Whitf. or H. arenaria, Bill.
Orthoceras bilineatum, Hall.
" Brainerdi, Whitf.
Gomphoceras minimum, Whitf.
Lituites Eatoni, Whitf.
" internastriata, Whitf.
Asaphus canalis, Conrad.
Bathyurus, resembling B. quadratus, Bill.

The strata of Division E are imperfectly exposed and somewhat crumpled. They crop out over a tract of about 30 acres, a mile northeast of the Lake, just east of the railroad, dipping 12° to the northeast, and seemingly undisturbed. A thickness of 140 feet is exposed on the three small islands in Ball's Bay, called the Cove Islands, where Primitia gregaria, Whitf. and P. cristata, Whitf. were collected (Bull. Am. Mus. of Nat. Hist., Vol. II, pp. 58–60), and later an undetermined species of Bathyurus. The dip varies from 16½° E. to 22½° E. and the strike from N. 47° E. to N. 72° E. The upper strata appear on the steep bluff fifty rods east of the islands considerably disturbed, and underlying the Chazy.

In this tract all the strata of the Chazy are well displayed and afford many species of fossils. To the south it is overlain by the Black River. To the east the rock is largely covered by soil, but in several hillocks and long ridges the broken fragments of Trenton limestone and Utica slate are abundant.

Along the north side of Thompson's Point, between it and Garden Island, appears to be a fault running east-northeast. North of this fault the Calciferous, Chazy and Black River again make their appearance but more steeply inclined than in the tract just described. The drab and buff limestones of Division E are, perhaps, better exposed here than on the south side of the fault and display a great thickness. Cedar Island consists of the base of Division C and is one of the few localities where fossils have been found in this division ; we collected here an undetermined Gasteropod resembling *Ophileta.* Garden Island is composed largely of the massive grey limestone of Division B.

Through McNeils Bay there seems to run a second fault, as on its north shore we find the Trenton limestone much contorted. Farther north it lies in a syncline with the Black River and Chazy in succession on either side. Still farther north, just outside the limit of the map, the Utica slate occurs, and is the only rock seen on the Vermont shore, except the Red Sandrock at Burlington, until we reach the tract next to be described.

## The Providence Island Section.

At Providence Island, twenty-four miles north of Thompson's Point, there is an interesting exposure of the upper part of Division D and the lower part of Division E. (See Maps 4 and 5 and Sec. No. 7). On the main body of the island the dip is N. 75° E. at an angle of 5° and the following strata occur in ascending order.

*a.* Calciferous sandstone, in layers 6 to 10 inches in thickness, containing *Maclurea affinis*, B. and *Asaphus canalis*, Con..... 71 ft.

*b.* Tough magnesian limestone weathering yellow in layers 1 foot in thickness..... 5 ft.

*c.* Sandy limestone weathering on the edges in ridges one or two inches apart, holding in a layer 14 ft. from the top, *Calaurops lituiformis*, Whitf. in abundance..... 28 ft.

*d.* Magnesian limestone more or less silicious, thin-bedded at first, then in massive beds, holding *Asaphus canalis*, Conrad..... 31 ft.

*e.* Blue or dove-colored limestone in beds 4 to 8 ft. in thickness, separated by thinner layers of magnesian limestone, containing *Lituites Seelyi*, Whitf.; *L. Eatoni*, Whitf.; *Nautilus Kelloggi*, Whitf.; *Maclurea affinis*, B.; *Orthoceras* sp.; *Holopea Cassina*, Whitf..... 44 ft.

*f.* Magnesian limestone in beds 2 to 3 ft. thick, holding at top abundant masses of scoriaceous black chert..... 10 ft.

*g.* Magnesian limestone holding small nodules of white chert..... 3 ft.

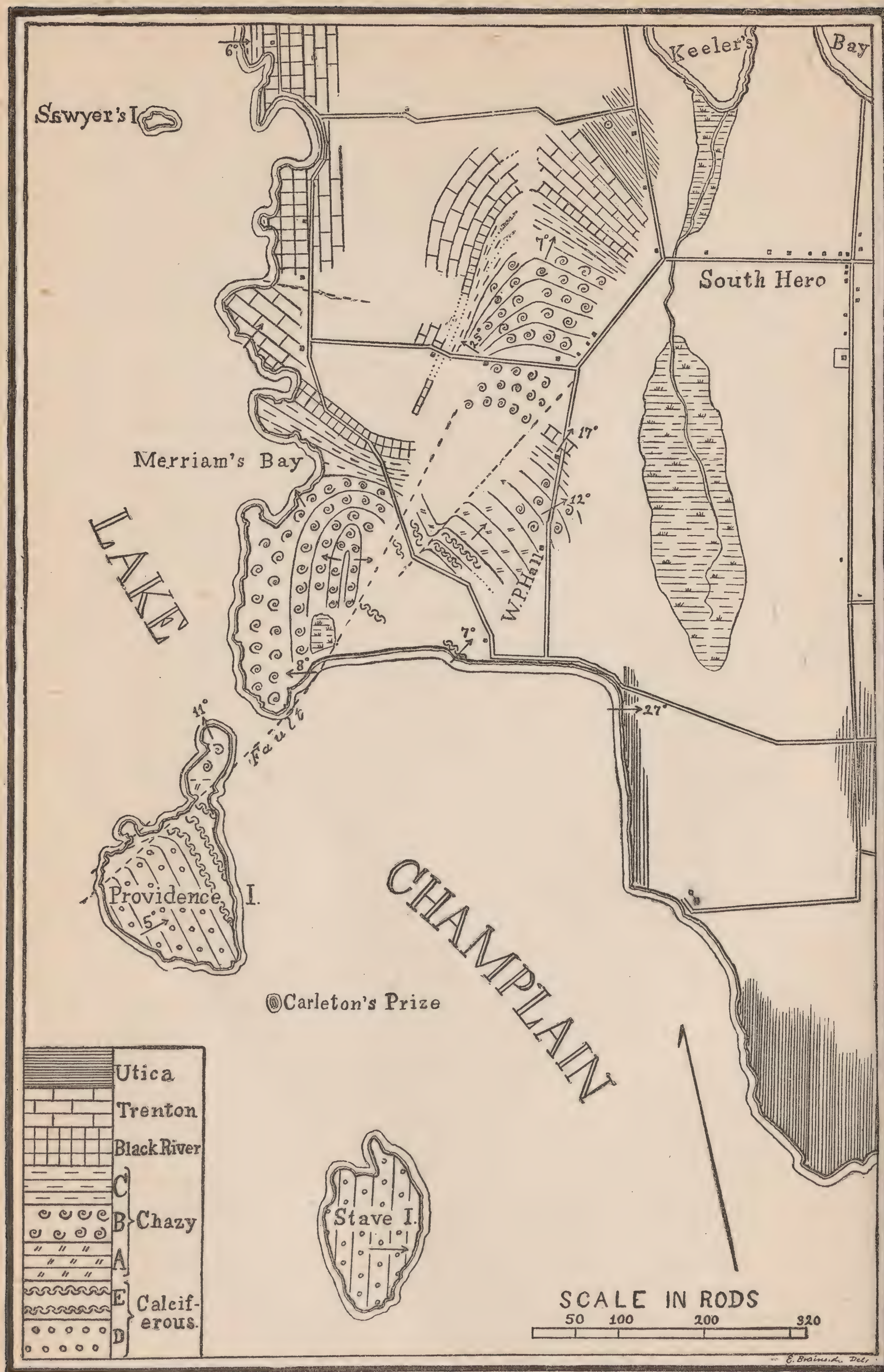
*h.* Magnesian limestone without chert weathering yellow..... 12 ft.

*i.* Concealed..... 20 ft.

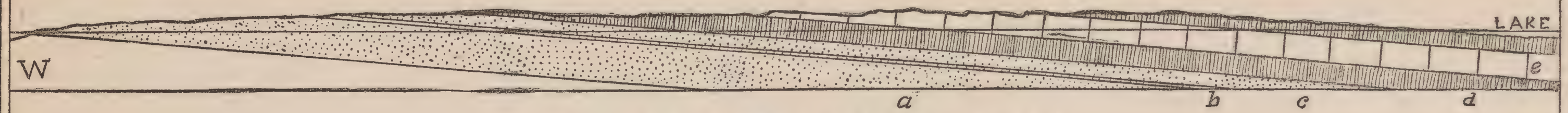
*j.* Tough magnesian limestone weathering yellow, with numerous fine black lines appearing on the fracture surfaces..... 7 ft.

*k.* Very tough, dark-colored limestone, with lenticular masses of compact black chert, in two layers parallel to the bedding and two feet apart, 5 ft.

In all..... 236 ft.




No. 4. PROVIDENCE ISLAND AND VICINITY




No 7. ACROSS PROVIDENCE ISLAND.

No. 8. NORTHWEST SHORE. PROVIDENCE ISLAND. NORTH PROMONTORY.

No. 9. SOUTH HERO, VT., NEAR MR. HALL'S.

E. Brainerd, Del.

SECTIONS ILLUSTRATING THE CALCIFEROUS OF THE CHAMPLAIN VALLEY.

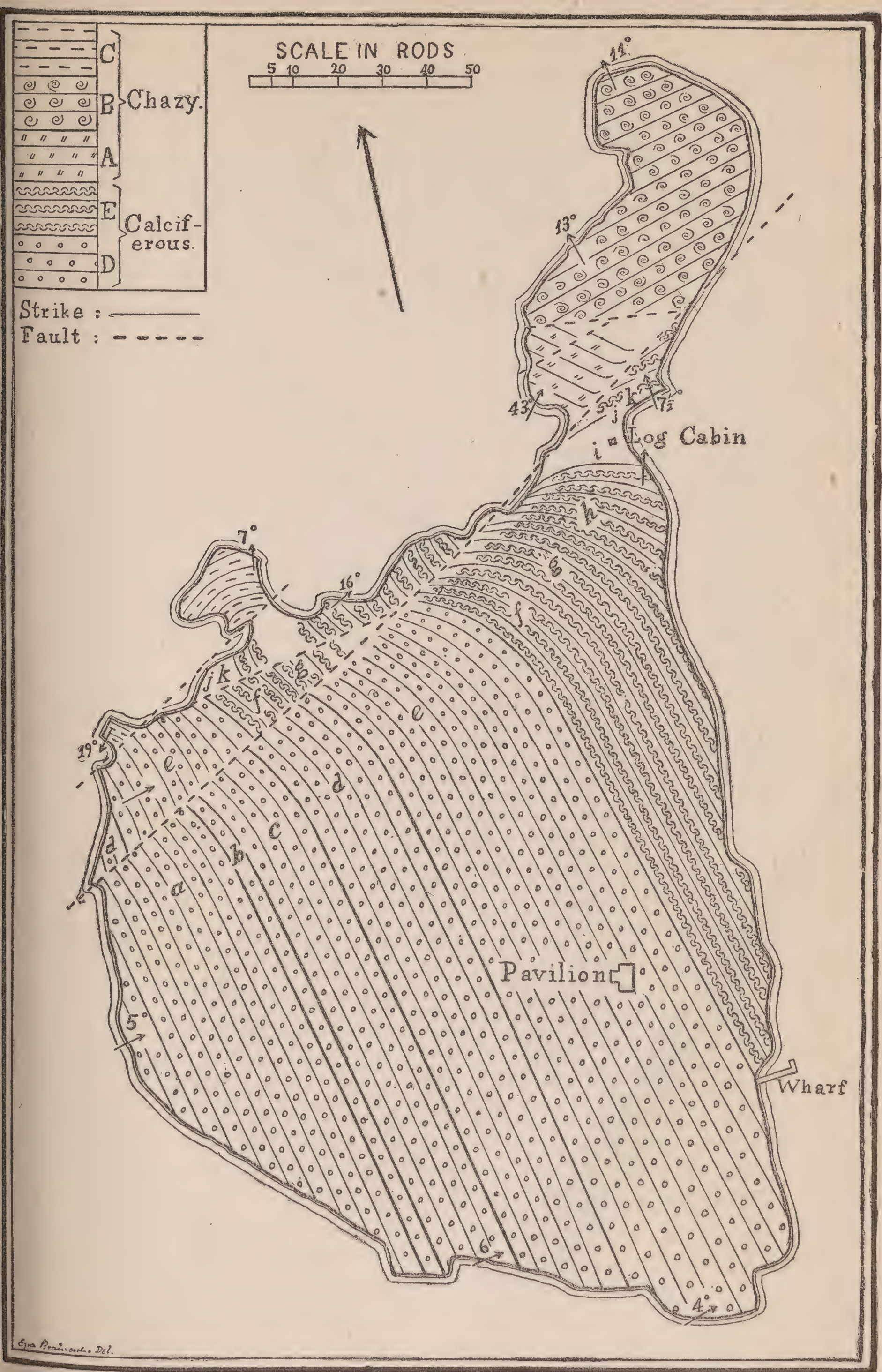
Vertical & horizontal scale in feet 100 200 300 400 500

Along the northwest shore of the island is a fault, which on the west divides into three branches, revealing in succession higher and higher strata on the northwest side of each branch. The two small peninsulas belong to the summit of the Chazy formation, and are filled with *Rhynchonella plena.* The western wedge-like mass consists of some of the strata already described. The eastern wedge-like mass, beginning with the peculiar strata marked *j* and *k* above, contains over 280 feet of still higher strata (see Section No. 8). The dip fluctuates between 14° and 22° N.E., the average of twelve measurements being 16° 25′. The rocks are tough magnesian limestones, weathering drab or buff, in beds one to three feet in thickness; but in three or four places there are intercalated beds of blue limestone 2 to 4 ft. thick, one containing *Murchisonia confusa*, Whitf.; *Primitia Seelyi*, Whitf.; *Bucania tripla*, Whitf., and *Lituites* (sp.?).

The strata above this exposure are for 35 rods concealed by the waters of the Lake, after which appear on the north headland about 230 feet of the Lower and Middle Chazy with abundant fossils. The strata here concealed may be seen on South Hero a mile and a quarter northeast, lying southeast of the fault which extends over two miles in this direction (see Sec. No. 9). They consist of magnesian limestones similar to those of Section 8 with at least one more bed of blue limestone containing Primitia, and of about 70 feet of the sandstone interstratified with impure limestone at the base of the Chazy. We regard all the magnesian rock above the 44 ft. of dove-colored limestone as equivalent to Division E of the Calciferous in Shoreham and Charlotte. The total thickness at Providence Island—450 to 500 feet—agrees well with the thickness observed at the south.

## The Fort Cassin Strata.

In Bull. No. 8, Vol. I, Am. Mus. of Nat. Hist., is an account of the strata at Fort Cassin, Vt., and a description of thirty-two new species of fossils found there. These rocks we believe belong to the upper part of Division D of the Calciferous for the following reasons: 1st. The frequent identity of the fossils in genera and species. 2d. The close resemblance in lithological features; the peculiar series *c*, *d* and *e* of the Providence Island




No. 5. PROVIDENCE. ISLAND, LAKE CHAMPLAIN.

section being but a repetition of the Ft. Cassin rocks. 3d. The entire absence of the Ft. Cassin strata in four different exposures of the Birdseye horizon within eight miles of Ft. Cassin, and in all other like exposures along the Lake.

The Birdseye formation is very scantily represented in Western Vermont. *Phytopsis tubulosum*, Hall, has been seen only in the northwest corner of Benson in a bed about 6 feet thick. Elsewhere we find in this horizon only a few feet of pure, fine-grained, brittle limestone with fine lines of calcspar, lighter in color than the known Black River strata just above, and without fossils. *Calymene multicostata*, Hall and *Illaenus crassicauda*, Dalm. found at Isle La Motte in strata which Prof. Hall supposed to be Birdseye (N. Y. Palæontology, Vol. I, pp. 228–229) belong to the dove-colored beds of the Upper Chazy, which elsewhere underlie strata over 75 feet thick composed largely of *Rhynchonella plena*. The *Calymene* is found elsewhere in this same horizon. *Cyrtoceras Boycii*, Whitf., *Sao ? Lamottensis*, Whitf. and *Lichas Champlainensis*, Whitf. belong also to the same beds of the Upper Chazy.

In describing the strata at Ft. Cassin and vicinity in Bull. No. 8, p. 298, where it was presumed that the upper Ft. Cassin beds were of the Birdseye formation, we wrote: "A necessary inference is that beneath the waters of Field's Bay there is either a fault running east and west, or an abrupt fold bringing up the lower rocks to the south" (see Map, p. 297, l. c.). We may now believe that the southerly dip continues all the way under Field's Bay without faulting, bringing the Ft. Cassin strata about 400 feet below the south shore strata, which are the upper magnesian beds of Division E. The fault must run through the mouth of Porter's Bay and is perhaps a northerly continuation of the fault observed running south from George Kellogg's. The rapid curvature in the strike at Appletree Pt. and at the point nearest to Ft. Cassin amounting to 74° in a few rods (as described p. 298, l. c.) is evidence of an upthrow of the strata once directly west. Diamond Island is a remnant of these strata. The fault is the north and south dislocation characteristic of the region—a downthrow on the east, like those at Ft. Ticonderoga.

## The Canadian Exposures.

At present only a brief reference can be made to the Philipsburgh series which extends four or five miles into Vermont. Logan's Division A, with its three subdivisions, 700 feet in thickness, (Geology of Can., 1863, p. 844) is lithologically identical with our divisions A, B and C, respectively, of the Calciferous.* The remarkable fossil, Cryptozoon Steeli (n. sp.) we have observed in the reticulated limestones of Logan's A, 2, at Philipsburgh. Similarly the first four members of Logan's Division B correspond to our Division D, both in lithological character and in fossils (see Geology of Can., 1863, pp. 278–279). The beds of calciferous sandstone are as prominent and peculiar at Philipsburgh as at Shoreham, and though not described by Sir William Logan as sandstones, they prove on analysis to consist far more largely of silicious matter than of calcareous. An escarpment of over fifty feet of the banded silicious limestone may be seen a little below the beds abounding in Lituites at the top of Logan's B, 3. The magnesian beds of our Division E are, however, but poorly represented in the lower part of Logan's Division B, 5. But, as already observed, they in a similar manner thin out and even disappear in the more eastern exposures of Addison Co., Vt. The higher beds of B, 5, at Philipsburgh and the beds of C, 1, seem to be represented in Western Vermont, but by the lower beds of the Chazy, which still await careful investigation.

A similar comparison might be made between the Calciferous of Lake Champlain and the 1830 feet of strata on the northwest coast of Newfoundland (Divisions D to L of the Geology of Canada, 1863, p. 865 et seq.). It seems to indicate that during this period the same physical conditions of sedimentation prevailed along the borders of the Archæan from Labrador at least to the head of Lake Champlain.

* Mr. Charles D. Wolcott, at the December meeting of the Am. Geolog. Soc., announced his discovery of Potsdam sandstone with characteristic fossils underlying these rocks on the shore of Missisquoi Bay.

ARTICLE II.—*Observations on the Fauna of the Rocks at Fort Cassin, Vermont, with Descriptions of a few New Species.* By R. P. WHITFIELD.

The fossils described in Bulletin No. 8, Vol. I, were referred at that time to the geological horizon of the Birdseye limestone from the best evidence then in my possession, partially on stratigraphical grounds, and partly on palæontological evidence, as based upon the forms of that formation and of those of the Black River beds given in the New York reports, that being almost the only supposed reliable material published of the fauna of those rocks. It appears, however, from the later investigations made by President E. Brainerd and Prof. H. M. Seely, of Middlebury College, Vermont, that the beds from which these fossils were obtained, hold a stratigraphical position below the true Chazy limestone. The close resemblance of the Fort Cassin fauna to forms described from the Canadian provinces by the late Mr. Billings, and referred by him to the horizon of the Calciferous beds of the New York reports, and to the Quebec rocks of the Canadian reports, was fully recognized at the time this study was being made, and several of them identified specifically, but from the uncertainty with which some of the references made in the Canadian reports have been regarded, it was deemed undesirable to place much reliance upon them in the face of other evidence possessed.

The Fort Cassin fossils were first submitted to me as Trenton limestone species, but on making a preliminary study I found them to be older, and on making a visit to the locality in company with President Brainerd and Prof. Seely I concluded they must be lower than the coral beds of the Black River limestone, seen a few miles south of them; and from their apparent relation to the *Maclurea magna* beds of the Chazy near by, as shown in the accompanying section, they would appear to be higher stratigraphically than the Chazy; while from their palæontological affinities, especially of the Cephalopods, to the Black River, as given in the New York Palæontology, their relations seemed pretty clear. The accompanying approximate section given of the locality, as it is seen from the lake, will readily show the features

then recognized, and explain to some extent the inferred structure. The bed containing the species *Calaurops lituiformis* lies about fifteen feet below the bed holding the Fort Cassin species, and dips below the water level just south of the site of the Fort at the mouth of Otter Creek. It passes below the water level and rises again near the north end of the promontory, while the *Maclurea* beds of the Chazy come up at a somewhat greater angle on the opposite side of the bay at Appletree Point, sixty-three rods north. The only way in which these beds of the Fort Cassin promontory can be placed below the Chazy beds at Appletree Point is by the *assumption* of a fault beneath the waters of the bay between, no evidence of such fault existing to the eye so far as can be ascertained from the stratigraphy.

In the same article in Bulletin No. 8, there were described, as from the Birdseye limestone of Isle La Motte, Lake Champlain, three species under the names *Cyrtoceras Boycii*, *Lichas Champlainensis*, and *Sao? Lamottensis*, which are found associated in rocks holding *Orthoceras Titan*, *O. bilineatum*, this last varying in size from one-third of an inch in diameter, with annulations one line apart, to those having a diameter fully two inches, and with annulations half an inch wide; also an Orthoceras resembling *O. multicameratum*, Hall, but varying slightly in being less tapering than the Watertown examples (possibly *O. moniliforme*, Hall), a Cyrtoceras of undetermined species, *Lituites convolvans?* Hall, and an undetermined Lituites. These beds were supposed to be the "Dove-colored limestones" of the Palæont. New York, Vol. I, and the fossils were sent to me as from the "Birdseye limestone of Isle La Motte." This bed has now been identified with layers which elsewhere underlie seventy-five feet of limestone holding the characteristic *Rhynchonella* of the Chazy limestone. So that the question very naturally arises as to the existence of any Birdseye limestone on Lake

Champlain other than what may be included within the limits of the Chazy limestone proper; or to a still lower horizon. So far as I can ascertain there is no New York locality known where the so-called Birdseye limestone beds are found in connection with beds containing *Maclurea magna* in such a condition as to prove satisfactorily that the Birdseye of the Mohawk Valley and the Black River region belongs stratigraphically above the true Chazy limestone; and one may ask if the limestones called Birdseye in the Mohawk Valley do not represent all the limestones on Lake Champlain which occur between those holding *Ophileta complanata* and those bearing the *Stromatocerium rugosum* and *Columnaria alveolata*, and recognized as equivalents of the Black River limestones, and if the Birdseye fauna, what there may be of it, does not properly belong below the *Maclurea magna* beds of Lake Champlain?

The result of these late investigations along Lake Champlain by Prest. Brainerd and Prof. Seely would place all but three of the fossils described in Bulletin No. 8, Vol. I, Am. Mus. Nat. Hist., below the horizon of the Chazy limestone, and the question arises as to what group of rocks they shall be assigned. They have been spoken of in all their recent articles, including that preceding this paper, as Calciferous, as they have referred everything to that formation that occurs between the Potsdam and Chazy. Many of the Fort Cassin fossils, which were identified specifically with forms described by Mr. Billings, were referred by him to the Calciferous, while perhaps the larger part were referred to the Quebec group. If we take as the fauna of the Calciferous the forms known from the beds holding *Ophileta complanata*, Vanuxem, and what few are known from the layers between that horizon and the Potsdam sandstone in New York, we have but a meagre showing, but have a fauna mostly destitute of the many species of Cephalopods, and also of most of the genera of Gasteropoda shown to exist in the Fort Cassin layers, most of which are continued upward into the Trenton limestones, so that very little similarity is seen between the faunas of the two horizons. In the description of the Lake Champlain rocks given by Profs. Brainerd and Seely, they make five distinct beds between the Potsdam and those recognized as Chazy, marking them as

A to E inclusive, and include the Fort Cassin layers and those containing *Ophileta complanata*, Vanuxem, in Division D, which division is stated to be 375 feet thick. In this division the *Ophileta* is found at the base and extends upward probably thirty feet; while the Fort Cassin fossils are confined to a very few feet at the very top of the division, the intervening layers being essentially unfossiliferous, or containing only a few obscure forms. In their lists of the fossils of the several beds the Ophileta is mentioned in connection with those of the upper layer in such a way that one might infer they were found together, which is probably not intended, as they are widely separated stratigraphically; and it appears to me that the dividing line between beds C and D should have been made above the Ophileta bed, as at that point there is considerable of a faunal change as well as a lithological one. The beds containing the Fort Cassin fossils are plainly a part of those considered by the Canadian geologists as their Quebec group, as may be seen by the description of the Philipsburg section given on pp. 278 and 279 of the Report for 1863, where it is referred to the Lévis group, although Mr. Billings, in Pal. Foss., Vol. I, refers many of the species to the Calciferous. It is evident they recognized a wide distinction between the Quebec fauna and that of the Calciferous proper, although in many cases confounding the fossils. There is certainly a much greater affinity between the Fort Cassin fossils and those of the rocks above them than with those of the Calciferous, and as the latter name applies to beds having peculiar lithological characters, and containing a very limited fauna, it appears to me much more natural to associate the later fauna with that of the rocks above, and place the limestones there also, or else to consider them as distinct from those below or above, and use a distinct name, as Fort Cassin, or Philipsburg formation, or any other appropriate one.

The following new species, and more perfect examples of some of the others, have been obtained more recently than those previously given.

*Descriptions of New Species and Observations on Previously Described Forms.*

## **Tryblidium conicum,** Whitf.

PLATE I, FIGS. 3 & 4.

*Tryblidium conicum*, Whitf.; Bulletin Am. Mus. Nat. Hist., Vol. I, No. 8, p. 306, Pl. 24, figs. 26 and 27, 32 and 33.

Specimens of a shell resembling *T. conicum* in some of its features, but showing extreme variations from the types, have been obtained from Fort Cassin. One form varies greatly in size, and in being more spreading and less oval in the outline of the basal margin, and more pointed at the extremities; one of these has a longitudinal diameter of one and five-eighths inches by fully one inch in height. A second form is broadly ovate on the margin, while the apex is obtusely rounded and directed toward the anterior, being placed nearer this margin than is seen in any other specimen; while the surface of the shell has been marked by concentric wavy lines. The former I have not much hesitancy in considering as identical with the *T. conicum*, but the latter I have strong doubts about, most particularly on account of the surface markings, but the specimen is not quite perfect enough to decide the matter, so for the present at least I shall place both forms under that name. They are all received from the University of Vermont, at Burlington, Vt., through Prof. G. H. Perkins, who collected them at Fort Cassin, Vt.

## **Ecculiomphalus triangulus,** n. sp.

PLATE I, FIGS. 5–9.

Shell of medium size, the greatest diameter of the largest example seen being less than two inches; consisting of from one to one and a half volutions, which are loosely coiled, so as not to be in contact at any point. Tube rather rapidly increasing in dimensions, triangular in a transverse section, the upper surface being flattened for fully three-fourths of its width, from which point it rapidly rounds and declines to the inner angle; the flattened upper surface only very slightly declining inwards; periph-

eral angle acute and the outer surface rapidly sloping inward to the rounded basal angle. Shell substance very thin, its surface characters unknown, except indistinct wavy lines crossing the shell and receding toward the acute angle. The apical portion is usually entirely filled with calcareous matter as the shell gets larger, thus shortening the inner coil of the casts, the only condition in which it is so far obtained.

*Formation and locality.*—In a grey semicrystalline limestone from Providence Island, Lake Champlain. Very abundant, and associated with *Maclurea affinis*, Bill., and fragments of an undetermined trilobite. Most of the specimens are marked by Prof. H. M. Seely as from his bed D.

## **Euomphalus Perkinsi,** n. sp.

PLATE I, FIGS. 10–14.

Shell of moderate size, closely coiled, but the volutions not impressed within each other to but a very limited extent, the coils being nearly on the plane of the axis, in one case, the upper side being the most concave, and in another the lower side is the deepest. Volutions three to three and a half in number, subcircular to subquadrangular in transverse section, being a little the widest outside of the center, and somewhat flatly convex on the back, giving to the aperture an indistinctly quadrangular outline, wider than high. Surface of the shell marked by raised, spiral ridges, indistinct on the sides, but strongly marked on the back; increasing in number with the increased size of the shell; also by strongly rugose transverse lines parallel to the margin of the aperture. On the upper side of the volution, at about one-third of its width from the back, there is a strong, raised, rounded ridge showing on the cast, indicating a similar ridge on the shell and probably a slit in the aperture at this point, showing its true relations to the genus *Euomphalus*. There is also a strong ridge or carina bordering the suture on the lower side of the volutions, but which gives no ridge on the cast as does that on the upper side.

This species is quite closely related to *Oriostoma dispar*, Lindstrom, figured in his Silurian Gasteropoda and Pteropoda of Gotland (Kongl. Svenska Vetenskaps-akademiens Handlingar, Vol.

19, No. 6, p. 173, Pl. 21, figs. 11–14), but has fewer volutions in a very much larger shell, while the tube has a greater vertical height in comparison to the width.

*Formation and locality.*—Fort Cassin beds on Lake Champlain, at Fort Cassin, Vt., presented by the University of Vermont, through Prof. G. H. Perkins.

## **Helicotoma similis,** n. sp.

PLATE I, FIGS. 1 & 2.

Shell discoid, with a depressed spire and flattened base, on which the volutions are very slightly convex between the sutures, but all on the one plane, so that when the shell is seen from this side it presents much the appearance of a Maclurea. Volutions about three in number in the best example seen, the tube quadrangular in a transverse section and somewhat rapidly increasing in dimensions with increased growth; as seen from above the volution presents three faces; the outer peripheral face is abruptly sloping, and the inner or umbilical face rather less so, and slightly rounded, while the third or upper face is slightly concave or flattened, while its outer boundary is elevated and rounded, being formed by the elevated ridge or carina formed by the apertural slit in the lip of the shell. Surface of the shell not definitely known, but it has been apparently devoid of any strongly marked features, judging from the smoothness of the exfoliated shell or partial cast.

The genus *Helicotoma*, although very closely related to *Ophileta*, is still sufficiently marked to be easily distinguished, as it always has the flattened space at the summit of the volution within the elevated carina or apertural ridge. The species, however, have no very strongly marked or distinctive features. Still this one may be readily distinguished from the other known forms by the flat base, the entire difference in the height of the tube of the young and older volutions being almost wholly seen on the upper side, the lower side only showing the slight convexity between the sutures, or a very slight concavity of the inner whorls.

*Formation and locality.*—In the Isochilina layer of bed E of Profs. Seely and Brainerd's section, Providence Island, Lake Champlain. Received from Prof. Seely under the name *Maclurea*.

## **Maclurea acuminata,** Billings.

PLATE II, FIGS. 1 & 2.

*Maclurea acuminata*, Billings; Pal. Foss., Vol. I, p. 240, fig. 225.

Several specimens have been obtained from different localities along the east shore of Lake Champlain, which are undoubtedly identical with the one from Newfoundland, described by Mr. Billings; but they differ from that one very materially in the form and size of the umbilicus, that one being described as being very small, and sometimes "apparently closed altogether," while in our examples all show it to be of considerable size, the most perfect one having it fully three-eighths of an inch in diameter, with steep, nearly vertical sides, and the edges quite sharp. The examples came from Thompson's Point, collected by President E. Brainerd; Fort Cassin, collected by Prof. G. H. Perkins; and from near Panton, Vt., collected and presented by Mrs. James Terry; all pertain to the Fort Cassin beds, which are at the top of Brainerd and Seely's division D.

## **Raphistoma Hortensia,** Billings?

PLATE I, FIGS. 15 & 16.

*Pleurotomaria Hortensia*, Billings; Pal. Foss. Can., Vol. I, p. 226 and 227, fig. 211.

A single individual, which I have referred to the above species with some doubt, was received from the University of Vermont, through Prof. G. H. Perkins, and was collected at Fort Cassin. This specimen is nearly three times as large as that figured as above, but presents the same deep basal side of the volution, and a rather narrow umbilicus, the margin of which is strongly rounded and tumid, while the opening, even in the large shell, is reduced to a very small size. It differs from any of the other forms of the genus in the great depth of the volution below the periphery, and in the fewer number and more rapidly increasing volutions.

## **Pleurotomaria difficilis,** n. sp.

PLATE I, FIGS. 15 & 16.

Shell rather small, globose, and about as high as the greatest diameter across the body volution, giving an apical angle of ninety degrees. Volutions three in number, very ventricose and round, with deeply marked suture lines and thin surfaces, covered with strong spiral ridges. Umbilicus either very small or imperforate. Aperture circular, or but slightly modified on the inner side by the preceding volution ; marked on the middle of the outer lip by a narrow slit, which forms a narrow raised band on the middle of the volution. Surface ridges somewhat irregular in strength and distance, six of them occur above the median band, and as many or more occur below ; the transverse striæ, which are parallel to the margin of the aperture, are directed strongly backward in crossing the volution to the median band, where they return and are directed as strongly forward again below.

We have no American shell that approaches so nearly to this one as does that described by Mr. Billings as *P. Calphurnia*, Pal. Foss. Can., Vol. I, p. 230, fig. 214, but I question the generic reference of that species, as it shows no band indicating an apertural slit, without which it would pertain more properly to the *Turbinidæ* than to the *Pleurotomariidæ*. Besides, the arrangement of the ridges and their comparative size is quite different, and the shell is very largely umbilicate ; while this one is nearly, if not quite, imperforate.

*Formation and locality.*—In the Fort Cassin beds, at Fort Cassin, Vt. Presented by the University of Vermont through Prof. G. H. Perkins.

## **Orthoceras explorator,** Billings.

PLATE II, FIG. 3.

*Orthoceras explorator*, Billings ; Pal. Foss. Can., Vol. I, p. 253, fig. 238.

A number of small fragments of a smooth, round *Orthoceras*, with a rapidly expanding tube and very excentric siphon of large size, was noticed in former collections of material from Fort

Cassin, but too indistinct for positive determination; but in a collection of specimens sent to the Museum by Prof. G. H. Perkins, from the State University of Vermont, there is one which is fully two inches long and perfect enough to show its relation to the above-named species. It differs from the figure of the Newfoundland shell given by Mr. Billings, as above quoted, only in having a somewhat larger siphon, which is placed in contact with the side of the shell instead of half its own diameter from the side, as there shown, but does not interrupt the continuation of the septa. This difference, however, I do not consider as of specific importance, as it may vary some in the same individual. The same undulation of the septa is noticeable, as is shown in Mr. Billing's figure.

### **Orthoceras sordidum,** Billings.

PLATE II, FIG. 4.

*Orthoceras sordidum*, Billings; Can. Nat. & Geologist, Vol. IV, p. 361 and 362, fig. 11, *i*. Also *O. Montrealensis* and *O. deparcum, ibid.*

A number of specimens of *Orthoceras* possessing the features shown in the figure given of *O. sordidum*, loc. cite., occurs in collections from the Fort Cassin beds; none of which are perfect enough, however, to give the full characters of the species, such as the depth of the septa and true size of the siphon. One fragment, two and a half inches in length, preserves fragments of the shell and shows it to be smooth and of moderate thickness; on it the septa count seven to eight in the space of half an inch; the siphon appears to have been in contact with the inside of the tube, but its size and form cannot be gotten from any of the specimens seen. In examples of different sizes the septa vary in their distances, and in the wavy or undulatory line where united to the tube. In consequence of these features I have concluded that *O. deparcum* and *O. Montrealensis*, Billings, figured on the same page with *O. sordidum*, are probably only variations of the same species. The specimens enumerated above are from Prof. Seely, of Middlebury, Vt., and from Prof. G. H. Perkins, of the State University of Vermont.

## **Orthoceras bilineatum,** Hall.

PLATE II, FIG. 5.

Pal. N. York, Vol 1, p. 35.

Numerous fragments of an annulated Orthoceras have been noticed among the collections from the Fort Cassin beds which I have considered as identical with the *O. bilineatum*, Hall, as it is recognized in the Black River beds in Northern New York, and from the dove-colored limestones of other parts of the State; although the minute surface markings supposed to be characteristic of that species have not been observed on any of the Fort Cassin specimens, the condition of preservation not being favorable for their preservation. Mr. Billings has described several species of annulated Orthocerata from the same geological horizon as the Fort Csssin specimens, among which *O. Lamarcki*, *O. priamus* and perhaps *O. furtium* may be specifically identical with them, as there appears to be no specific feature by which they can be separated, or any that is not variable enough to cover all the individuals. From a close comparison of these Champlain specimens with forms from Watertown, and from the dove-colored limestones of Isle La Motte, I see no feature by which I can distinguish them as species: even those of the Trenton limestones vary very greatly, not only in the rate of increase in size, but in the distance between the annulations which govern the length of the chambers also; while often on an individual of only a few inches in length the rate of increase will vary very greatly. In fact, this is a general character of all these annulated forms even to those of the upper Helderberg and Hamilton groups, where it is not at all uncommon to find on specimen of six or eight inches in length characters corresponding to those of two or three of the described species. For these reasons I have not attempted to divide the Fort Cassin specimens according to the various names given, but have classed them under the earlier name used.

In Bulletin No. 8, of Vol. I, p. 339, I described a new trilobite under the name *Bathyurus? Seelyi*, which differs so widely from the typical forms of that genus that I propose to separate it under a new name. At the time the species was described the only glabellas known were so much compressed that the true outline could only be surmised, and for that reason I was unwilling to

propose a new name. Since then Prof. G. H. Perkins, of the State University of Vermont, has sent me a smaller glabella, which shows the true form to be almost that of a hemisphere, very much like that of *Sphærexochus*, but to differ in many respects from any known genus, and I now propose to separate it under the name *Bolbocephalus*, in allusion to the bulbiform or subspherical outline of this part of the organism.

BOLBOCEPHALUS, New Genus.

*βολβός*, bulb; and *κεφαλή*, head.

*For generic illustration*, see PLATE III, FIGS. 1–8.

Head large, semicircular, including the movable cheeks; glabella proportionally large, bulbous or subspherical, expanded in front of the eyes, and marked by a single very indistinct furrow near the posterior only; fixed cheeks narrow; eyes large, semicircular, elevated; lateral limbs narrow from front posteriorly; frontal limb linear; facial suture cutting the posterior margin within the genal angle behind, and passing closely around the glabellar lobe in front. Movable cheeks triangular, margined, and in the type species armed with spines.

Thorax unknown.

Pygidium semicircular, very distinctly lobed, both axis and lateral lobes marked by transverse furrows.

The genus would appear to belong to the *Asaphidæ*, and is nearly related to *Dolichometopus* of Angelin, but differs very materially in the form of the glabella and central parts of the head, and in the direction of the facial sutures, which appear to cut off the anterior border very close to the front of the glabellar lobe, as none of these individuals observed show more than the narrowest line of crust below the bulb. The imperfection of the material possessed renders it impossible at this time to give a full and complete diagnosis of the characters, as none of the thoracic rings have been found attached either to the head or pygidium, many of the latter being in the collection; and those which are suspected to belong to this species are so very similar to segments of *Asaphus canalis*, associated in the same rock, that I have not felt it safe to include them. There are also two distinct forms of pygidial plates found in the layer containing the cephalic por-

tions, either of which might belong to it, but no other head portion bearing characters at all corresponding in size or general features have been found nearer than the small forms of *Bathyurus*, none of which have anything like the necessary size naturally required by such tail plates. The present species, *Bolbocephalus Seelyi* (= *Bathyurus Seelyi*, Whitf. ; Bulletin Am. Mus. Nat. Hist., Vol. I, No. 8, p. 339), is remarkable for its strong, robust and deeply marked characteristics, both in the head parts and the pygidiæ, which I have associated with it under the same name. The pygidium described below is the second one which is referred to, but it lacks the boldness of character possessed by that referred to the *Seelyi*, and in this respect corresponds less strongly to the features of other parts of that species. I have doubtfully identified it with the same genus.

### **Bolbocephalus ? truncatus,** n. sp.

PLATE II, FIGS. 6–8.

Organism known only from the pygidial plate, which is paraboloid in general outline, and very convex, about two-thirds as long as wide, and with the anterior margin comparatively only slightly arcuate. Axial lobe broad, depressed convex, and rising but slightly above the general convexity of the entire plate, occupying more than one-third of the entire width, and extending a little more than half the length, squarely truncate posteriorly, and marked by three very faint transverse furrows, exclusive of the anterior articulating constriction ; the dorsal furrows which separate it from the lateral lobes being distinct but not strongly marked. Lateral lobes consisting of a single convexity from the dorsal furrows to the outer margin, without any evidence of marginal rim, and continuing around the posterior of the plate without any break, and of nearly the same width ; marked anteriorly by a single, and possibly, in some cases, by two, annular furrows, the ring being slightly depressed along its center, the furrow not extending below the middle of the lobe. Under side of the plate strongly arched upwards in the center, when viewed from behind. Surface smooth.

The species needs comparison with *Dolichometopus ? rarus*, Billings, as figured on p. 352, Vol. I, Pal. Foss. Canada, fig. 338.

It, however, differs very materially in the form and proportions of the axial lobe, being squarely truncate behind, instead of being acutely obconical as in that one, and in being less prominent and proportionally wider. These features are constant on several individuals, both of young and grown examples.

*Formation and locality.*—In the Fort Cassin beds, at Fort Cassin, Lake Champlain, from Prof. G. H. Perkins, of the State University; and in specimens from Profs. Brainerd and Seely marked as from Delong's, near Shoreham, Vt.

### **Bathyurus (Bathyurellus) glandicephalus,** n. sp.

PLATE II, FIGS. 9–13.

This species is based upon separate glabellas, more or less imperfect, and separated pygidial plates. The glabella and fixed cheeks united have an elongated quadrangular outline, the glabella being of a very elongate form, and very narrow proportionally; elongate, conical from the middle upward, and rather narrow behind and at the occipital ring, having in the whole almost the form of an elongated conical gun-projectile, and is marked by two or more pairs of short obscure furrows. As seen in profile, this whole lobe is strongly arcuate from front to rear. Fixed cheeks narrow; eyes prominent, the lobes rounded; frontal limb narrow concave, the sides and front rounded; posterior limbs narrow; facial suture curving inwards in front of the glabella, rounding the sides of the frontal limb.

The pygidium, which is associated with the glabella above described, and which, from the peculiar markings characteristic of both, I have supposed to belong with it, is paraboloid in outline, with a nearly straight anterior margin. The axial lobe is narrow, prominent, extends to within a short distance of the posterior border, and is marked by five rings distinct from the anterior articulating ring, and the long posterior or terminal one, the latter being possibly in some specimens divided by a sixth constriction. Lateral lobes very much wider than the axial lobe, very convex and marked by four very strong rings, exclusive of the anterior one. A narrow, slightly concave marginal border extends entirely around the plate. Surface covered by fine wavy lines, as is also the glabella, even on the palpebral lobes and frontal limb.

There are four species of *Bathyurellus* described by Mr. Billings, which have some resemblance to this one, as far as the form of the glabella goes; they are *B. abruptus*, *B. marginatus*, *B. nitidus* and *B. formosus*, and are figured on pp. 263 and 265 of Vol. I, Pal. Foss. Canada. I do not believe them all to be good species, but I cannot identify the present one with any one of them, still it is possible that it may be specifically identical with them all, only representing another phase of the same species; but even in this event none of the names there used can be safely applied to this one, as the features described under those species preclude this one; but when we consider the pygidium associated with this form, the similarity entirely disappears, as none of those there given resembles this one in any degree. Therefore, I apply an entirely new name to designate it.

*Formation and locality.*—In bed E of Brainerd and Seely's section, above the Fort Cassin bed at Shoreham, Vermont. In Profs. Brainerd and Seely's collections.

Besides the above species there are fragments of several other trilobites which have been noticed associated in the same beds, most of them, however, are too imperfect for use. On a fragment of rock from Bridport, Vt., there are two pygidial plates of the form described by Mr. Billings as *Bathyurus caudatus*, Pal. Foss. Can., Vol. I, p. 261, fig. 245. There is also the glabella of a trilobite from Stave Island, and from Thompson's Point, Lake Champlain, which somewhat closely resembles *Bathyurus quadratus*, Billings, Pal. Foss. Can., Vol. I, p. 411, fig. 396; but it has a much wider frontal limb, very much narrower fixed cheek, with larger eye lobes and very short, narrowly triangular lateral limbs, differing in these respects so greatly that it cannot be considered specifically identical. As these are only very imperfect specimens, however, I shall not further describe it at present.

*Amphion sp.?* Several imperfect heads of a species resembling the genus *Amphion*, Fischer, exists in the collection from bed E, at Shoreham. It is of small size, the glabella above being scarcely one-third of an inch across, and very strongly marked. They are all so imperfect that I cannot identify them positively with any described species, and they do not afford bases enough for a description and figure.

## EXPLANATION OF PLATE 1.

### **Helicotoma similis,** Whitf. Page 31.

*Fig.* 1. The lower flat surface of the shell.

*Fig.* 2. Upper surface or spire, denuded of the shell, but showing the ridge left by the slit of the aperture.

### **Tryblidium conicum,** Whitf. Page 29.

*Fig.* 3. View of a specimen partially restored, showing the surface markings.

*Fig.* 4. Cast of a large individual.

### **Ecculiomphalus triangulus,** Whitf. Page 29.

*Figs.* 5 & 6. Upper side of a small cast, and a diagram of the section.

*Figs.* 7 & 8. Opposite sides of a large individual.

*Fig.* 9. Profile view from the inner side.

### **Euomphalus Perkinsi,** Whitf. Page 30.

*Figs.* 10 & 11. View of the under surface preserving some of the shell with the surface markings, and an enlargement of the surface.

*Fig.* 10. Restored view of the back; part of the shell only preserved on the specimen.

*Figs.* 12 & 13. Views of the upper and lower sides of an internal cast, showing the tube to have been round on the inside.

*Fig.* 14. Ideal section of the specimen, fig. 10.

### **Raphistoma Hortensia,** Bill. Page 32.

*Figs.* 15 & 16. Front and basal views of a large individual.

### **Pleurotomaria difficilis,** Whitf. Page 33.

*Figs.* 17 & 18. View of the back of the specimen described and an enlargement of the surface.

# FORT CASSIN FOSSILS.

(Gasteropoda.)

L. P. Gradacap, del.

## EXPLANATION OF PLATE 2.

**Maclurea acuminata,** Bill. Page 32.

*Figs.* 1 & 2. View of the flat surface and front view, the latter showing the umbilical depression or depressed spire, if it is so considered.

**Orthoceras explorata,** Bill.? Page 33.

*Fig.* 3. View of a specimen which I have considered as doubtfully of this species.

**Orthoceras sordidum,** Bill. Page 34.

*Fig.* 4. View of a fragment identical with the above-named species. The specimen shows the septa interrupted by the siphon reaching the inside of the tube.

**Orthoceras bilineatum,** Hall. Page 35.

*Fig.* 5. View of a cast which represents the above named species.

**Bolbocephalus truncatus,** Whitf. Page 37.

*Fig.* 6. View of the pygidial plate described, nat. size.

*Fig.* 7. Posterior view outline showing the upward curving of the under surface.

*Fig.* 8. Profile of the same.

**Bathyurus (Bathyurella) glandicephalus,** Whitf. Page 38.

*Fig.* 9. View of a glabella, nat. size.

*Fig.* 10. Profile of the same.

*Fig.* 11. Enlargement of the surface.

*Figs.* 12 & 13. Top view of the pygidial plate and an outline profile.

# FORT CASSIN FOSSILS.

L. P. Gradacap, del.

## EXPLANATION OF PLATE 3.

*Generic illustrations of Bolbocephalus.*

**Bolbocephalus Seelyi,** Whitf. Page 36.

*Figs.* 1 & 2. Top and profile views of a small glabella that is entirely uncompressed, giving the true form. Enlarged two diameters.

*Figs.* 3 & 4. Profile and top view of the type of the species, nat. size.

*Fig.* 5. Profile of a second glabella, but very slightly compressed.

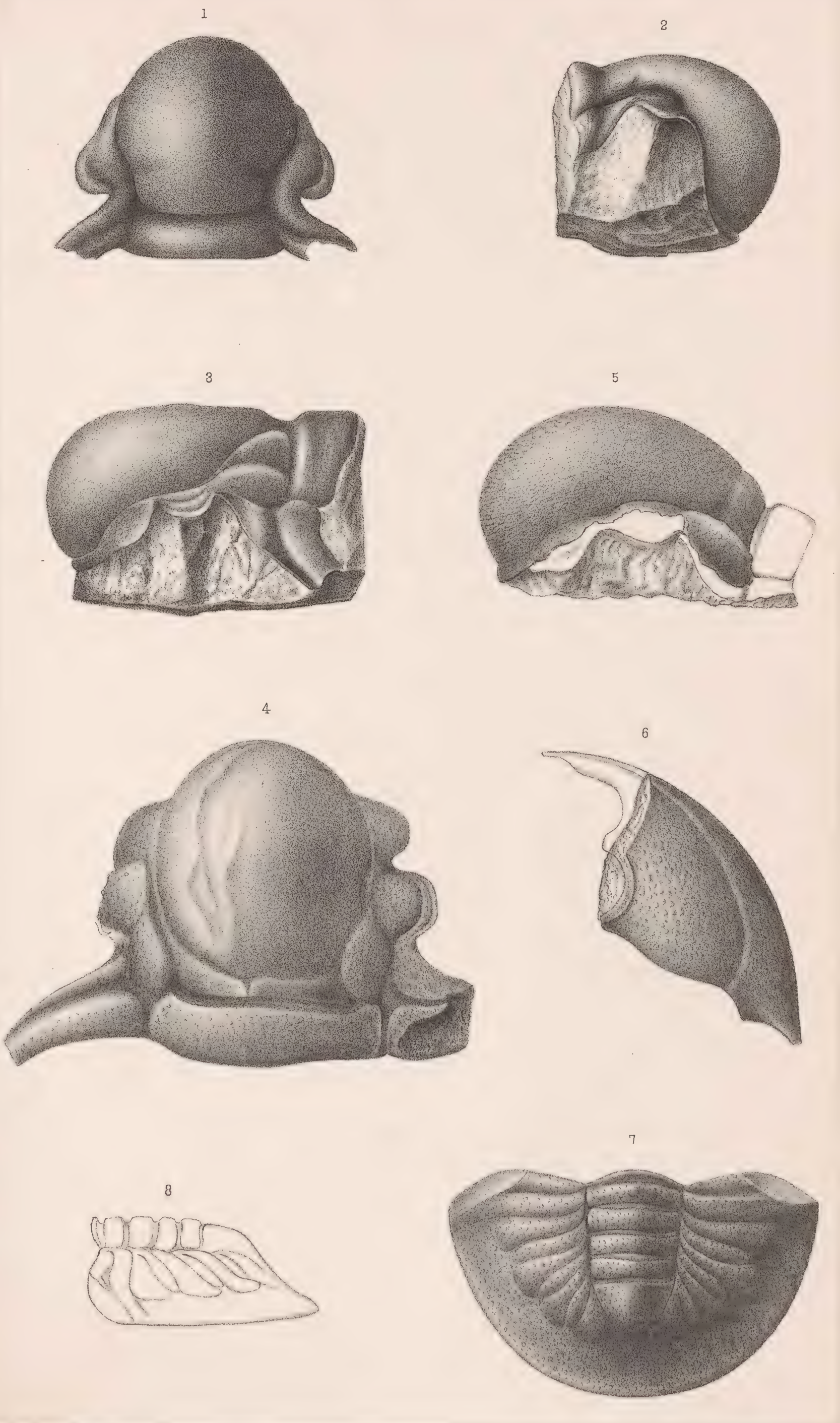
*Fig.* 6. View of a movable check, nat. size.

*Figs.* 7 & 8. Top view and outline profile of a pygidum. All these figures, except 1 and 2, were given with the original description of the species.

# FORT CASSIN FOSSILS.

(Crustacea.)






R.P.W. del.

ARTICLE III.—*On Seasonal Variations in Color in Sciurus hudsonius.* By J. A. ALLEN.

In preparing my Monograph of the American Sciuridæ, published in 1877,* my attention was attracted to what appeared to be well-marked seasonal variations in color in the common Chickaree or Red Squirrel (*Sciurus hudsonius*), particularly in respect to the presence or absence of the black line on the sides of the body. Although I had hundreds of specimens before me for examination, a few only were labeled with the date of capture. Of this material I said: "A small proportion of the specimens have a conspicuous black lateral line separating the white of the lower surface from the gray of the upper surface. Generally, not more than one specimen in ten is thus marked, and such specimens are found, on careful examination, to be in summer pelage. Yet only a small proportion of those in summer pelage are thus marked, while I have never met with it in any specimen in winter pelage. Many of those thus marked are evidently the young of the year, and I am hence led to believe that it is a temporary feature of coloration characteristic of animals less than a year old, and that it permanently disappears with the first autumnal moult. I find, however, two specimens with a distinct lateral line that are adult females" (l. c., p. 674). These conclusions were not based on an actual knowledge of the date of capture of the specimens examined, but on the general character of the pelage. Although the real state of the case is roughly outlined in the above quotation, it is in part erroneous, as more satisfactory material now enables me to show. The presence or absence of the black lateral line is not at all dependent upon age, but is strictly a seasonal feature.

This is shown by a large series of specimens collected mainly at Hastings, on the Hudson River, near New York City, by Mr. John Rowley, Jr., for the American Museum of Natural History, with the express purpose of showing the seasonal changes of color in the present species. The series numbers nearly sixty specimens, taken throughout the year, except during the months of June and July, these two months being unrepresented.

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* Coues and Allen, Monographs of North American Rodentia. No. XI. Sciuridæ. <Report of the United States Geological Survey of the Territories (F. V. Hayden, United States Geologist-in-charge), Vol. XI, 1877, pp. 631-949.

To begin with the spring moult, specimens taken at various dates in April and May show no great change in color from mid-winter specimens; the coat, however, has become thinner, and is more or less worn and ragged. Signs of its renewal are seen on the feet, where the gray of the toes is already replaced by the yellowish rufous of the summer coat, which also appears in patches on the fore-arms and shoulders, even in specimens taken as early as April 19 and 26. Other specimens taken as late as the middle of May are but little more advanced toward the summer coat. During June and July the moult is completed, as specimens taken August 6 are in full summer pelage.

In August specimens the pelage is short and close, and the color very different from that of winter. The general color above is more rufous and the broad dorsal band of bright rufous, so characteristic of winter specimens, is entirely absent. The limbs externally and the upper surface of the feet are bright yellowish rufous, quite different from the gray or pale yellowish gray of these parts in winter. The lower surface of the body is snowy white, this color extending nearly to the roots of the hairs, instead of grayish white, as in winter specimens, when the dusky tint of the basal portion of the hairs comes so near the surface as to impart to it a grayish tinge. The lateral line is clearly shown, but is less intense black and not so clearly defined as later in the season. It is much stronger in specimens taken August 23 and 30 than in those taken August 6.

The redness of the coat and the distinctness and intensity of the black lateral line reach their highest development in September and October. In November the pelage becomes longer, thicker, and softer; the feet and the outer surface of the limbs begin to lose their redness, and the broad red dorsal band begins to be apparent, through the growth of long red hairs which are not subterminally ringed with black, as are those of the summer coat. In specimens taken in the early part of November the lateral line still remains distinct, but in those taken near the close of this month it has become much less prominent, and practically disappears early in December, while the rufous dorsal band becomes purer and broader. The feet have become gray or yellowish gray, and the general color of the sides and whole upper

surface (except the middle of the back) has changed to a yellowish or olivaceous gray. In November specimens the feet are still yellowish rufous, this color also extending up the extremities to near the elbow and knee. In a specimen taken December 4 the gray has worked down on the hind feet nearly to the base of the toes, and the yellowish rufous is fading out on the fore-arms, while in another, taken the same day, only the tops of the feet retain the summer coat. Specimens taken December 16–20 have the feet wholly gray above, the only trace of the summer coat being a few yellowish hairs about the tips of the toes.

There is little further change till April, when the cycle of change above outlined again begins. Towards spring (in February and March) the broad dorsal band of rufous appears to attain its greatest intensity, and the feet show the minimum amount of fulvous.

It should be added that the black lateral line rarely wholly disappears; it is occasionally distinctly traceable in winter specimens, but in such the rufous dorsal band is not well developed, and the specimens show other indications of immaturity. In fully adults in winter the lateral line is not readily traceable without parting the hairs, when those covering this area are found to be more dusky at the base than are the hairs on either side of it. In many specimens, however, there is not even this faint trace remaining.

It thus appears that the black lateral line is distinctively a feature of the summer pelage, as the broad rufous dorsal band is of the winter pelage. Also that the summer pelage is characterized by the strong yellowish rufous tint of the whole dorsal aspect, including the sides of the body, and especially the feet and outer surface of the limbs, which are then in strong contrast with the olivaceous gray of these parts in winter. In summer the outer surface of the limbs and sides of the body are more rufous than the middle of the back; in winter the middle of the back is clear rufous, and the sides and limbs yellowish gray, a more or less well-defined and rather broad band of bright rufous extending along the middle of the back to nearly the end of the tail, in strong contrast with the rest of the dorsal surface.

The young are born while the parents are still in the winter coat, or at about the time of the beginning of the change from

winter to summer pelage—that is, during the month of April. The first coat of the young is similar to the summer coat of the adults, as shown by a litter of half-grown young, taken early in May, in the Museum Collection; they having the strong black lateral line, the feet and limbs bright rusty, and the general coloration of the adults in late summer and early autumn.

A careful examination of the series above described shows that the change of color, both in spring and fall, is due to a change of coat. In the summer coat the pelage of the dorsal surface is plumbeous at base, with the apical half or two-thirds of the hairs yellowish rusty, ringed narrowly near the tip with black. The hairs covering the ears, and a small area at the posterior base of the ears, the upper surface of the hind feet, and the whole external surface of the fore limbs, including the sides of the shoulders, lack the subapical black ring characterizing the hairs of the rest of the upper surface of the body. In the winter pelage the hairs clothing the limbs are pale yellowish gray conspicuously ringed subterminally with black; the general color becomes less rufous and grayer, and the black-ringed hairs along the middle of the back give place to much longer hairs wholly red from the plumbeous basal portion to the tip. The bright red hair fringing the ears is replaced by blackish; the reddish patch behind the ears becomes merged with the red of the dorsal band; and the black hairs forming the lateral lines are shed.

It is thus evident that the seasonal change of color is produced, not by any change of color in the hairs themselves, or by any overgrowth of hairs of a different color, as might be supposed in the case of the autumnal change, but by a complete renewal, twice a year, of the hairs themselves.

While in birds the gradual replacement of feathers during moult can be easily observed through the presence of growing feathers in various stages of development, the case is different with mammals, since the growth of the new hairs cannot be readily detected; nor is the change easy to recognize except in cases like the present, where the individual hairs of the alternating seasonal coats differ markedly in coloration.

ARTICLE IV.—*A Review of Some of the North American Ground Squirrels of the Genus Tamias.* By J. A. ALLEN.

> "But does not the difficulty rest much on our silently assuming that we know more than we do? I have literally found nothing so difficult as to try and always remember our ignorance."—C. DARWIN, *Life and Letters*, Am. ed., Vol. II, p. 209.
>
> "We know in part, and we prophesy in part."—PAUL, I. Cor., xiii: 9.

Since the publication of my revision of the genus *Tamias*, in 1877,* our knowledge of the group has greatly increased. Several new forms have been described, and the material for study is not only vastly increased, but immensely improved in quality. Many important localities from which there was then no material are now represented by fine series of beautifully prepared specimens; and generally, in place of the few distorted and more or less imperfect skins of fifteen years ago, often without dates of capture, we have now carefully-prepared specimens in large numbers, with full data respecting locality and season of capture, and generally measurements of the specimens taken before skinning.

The credit for this greatly improved condition of affairs, not only in respect to the present group, but to North American mammalogy at large, is due mainly to Dr. C. Hart Merriam, Chief of the Division of Economic Ornithology and Mammalogy in the United States Department of Agriculture, who for the past six or eight years has devoted much time, money, and energy to the formation of an ideal collection of the smaller mammals of North America. Recognizing at the outset the importance of well-prepared material, he has taken great pains to instruct his collectors as to the best methods of collecting and preparing cabinet specimens. He has thus not only secured for himself specimens of the best quality in large series, but has educated collectors up to a high standard of excellence in all that relates to field work in mammalogy, and in this way done much to improve the quality of the mammalogical material supplied to our public and private museums. It is safe to say that seven-eighths of the really good material forming the basis of the present paper owes its origin, directly or indirectly, to Dr. Merriam's influence.

The present paper is simply a revision of the "*Tamias asiaticus*" group of my former monograph. It therefore does not

* Coues and Allen's "Monographs of North American Rodentia" (Hayden's Rep. U. S. Geol. Sur., Vol. XI), 1877, pp. 779–819.

cover the *striatus*, *lateralis*, and *harrisi* groups of the genus *Tamias*. Of the "*T. asiaticus*" group I had in hand, in 1877, about 225 specimens (excluding skulls), of which only 75 are again before me. The number of skins forming the basis of the present review is over 650 (besides a large number of skulls), of which at least five-sixths are in fine condition, with complete field data. The greater part of this material has been gathered during the last four years, and is principally from the following sources: (1) the American Museum of Natural History; (2) the Museum of Comparative Zoölogy, Cambridge, Mass., received through Mr. William Brewster, Curator of the Department of Mammals and Birds; (3) the United States National Museum, Washington, D. C., through Mr. F. W. True, Curator of the Department of Mammals; (4) the United States Department of Agriculture, through Dr. C. Hart Merriam, Chief of the Division of Economic Ornithology and Mammalogy; (5) the private collection of Dr. C. Hart Merriam. I am also indebted to Mr. F. Stephens, of Santa Ysabel, Cal., and to Mr. W. E. Bryant, of San Francisco, Cal., for the loan of valuable material. To each of these gentlemen my hearty thanks are tendered for their kind offices. I am especially under obligations to Dr. Merriam, to whom I am indebted for fully one-half of the material forming the basis of the present paper, and without which its preparation would have been impossible.

In 1877 six forms were associated under the specific name *Tamias asiaticus*, as follows:

1. *Tamias asiaticus.—Hab.* Northeastern Europe and Northern Asia.

2. *Tamias asiaticus borealis.—Hab.* Northern North America, south to the northern border of the United States.

3. *Tamias asiaticus quadrivittatus.—Hab.* Middle and southern portions of the Rocky Mountains, and in the mountain ranges thence westward to the Pacific coast.

4. *Tamias asiaticus pallidus.—Hab.* The dry plains of the Upper Missouri and Yellowstone Rivers, and the desert plains and badlands thence westward to and including the Great Basin.

5. *Tamias asiaticus townsendii.—Hab.* Pacific coast, from Central California north to British Columbia.

6. *Tamias asiaticus dorsalis.—Hab.* The Great Basin, and southward and eastward to Mexico and New Mexico.

To these six forms have recently been added four others, as follows:

7. *Tamias macrorhabdotes.** —*Hab.* Sierra Nevada, Placer Co., California.

8. *Tamias asiaticus bulleri.*†—*Hab.* Sierra de Valparaiso, Zacatecas, Central Mexico.

9. *Tamias asiaticas merriami.* † —*Hab.* San Bernardino Mountains, Southern California.

10. *Tamias asiaticus hindsii.*†—*Hab.* Coast region of Northern California, and probably of Oregon. (A southern form of *T. townsendii.*)

Only the last named of these four recently added forms was represented in the material studied by me in 1877.

In considering the relationship of the form from Central Mexico, some months since,‡ the material then at hand in the collection of the American Museum of Natural History showed the necessity of a thorough revision of the nomenclature and status of the forms of late currently associated under the name *Tamias asiaticus.*

As has been previously recognized,§ the components of the genus *Tamias* are "peculiarly susceptable to environmental influences," and the question of how best to treat the various series of specimens from different localities, showing recognizable phases of variation — often slight, but frequently quite pronounced—is the difficult problem in the present investigation. In the material before me not less than 21 localities are represented by from 8 to 40 specimens each; about 13 other localities are represented by from 3 to 6 specimens, and many others by a single specimen each. These localities are scattered from the Fur

* Merriam, Proc. Biol. Soc. of Washington, Vol. III, p. 25, Dec. 26, 1885.
† Allen, Bull. Am. Mus. Nat. Hist., Vol. II, No. 3, pp. 173–179, Oct. 21, 1889.
‡ See Bull. Am. Mus. Nat. Hist., Vol. II, pp. 173–179, Oct., 1889.
§ See Merriam, Proc. Biolog. Soc. Washington, Vol. III, p. 28; also the present writer, Bull. Am. Mus. Nat. Hist., Vol. II, p. 178.

Countries of the far North to the State of Zacatecas in Central Mexico, and from the Pacific coast to the eastern base of the Rocky Mountains in Colorado, and thence further eastward to the Dakotas, and even to Northeastern Minnesota, Northern Michigan, and Western Ontario. The localities best represented are the following: Zacatecas, Mexico, 12; San Pedro, Lower California, 8; Apache County, Arizona, 7; San Francisco Peak and adjacent Mogollon Mountains, Arizona, 34; San Bernardino Mountains, Southern California, 46; Blue Cañon, Placer Co., California, 40; Donner, Placer Co., California, 45; Coast Region of Northern California, 40; Coast Region of Oregon, 11; Fort Klamath, Oregon, 12; Coast Region of Washington, 24; Coast Region of British Columbia, 17; interior of British Columbia, 16; Helena, Montana, 14; Chief Mountain Lake, near the northern boundary of Montana, 9; Ogden (and vicinity), Utah, 16; Green River, Wyoming, 20; Colorado (chiefly Boulder and Park Counties), 38; San Pedro, New Mexico, 9; Black Hills, South Dakota, 15; Turtle Mountain, North Dakota, 8; vicinity of Lake Superior, 8; British America east of the Rocky Mountains (various localities), 11.

On the other hand, there is practically nothing from Idaho, Nevada, and Utah (except the northern border); in short, very little from the vast Great Basin area north of Utah.

There is almost nothing from the main Rocky Mountain chain between Helena, Montana, and Central Colorado; nothing from the Big Horn Mountains of Wyoming, the Bitter Root Range of Idaho, or the Blue Mountains of Oregon; and nothing from Mexico north of Zacatecas; large areas east of the Rocky Mountains are represented by only a few scattered specimens; and about a dozen specimens comprise all of the material from British North America, outside of British Columbia. Three specimens comprise the total from the "Palæarctic Region."

The series from different localities are not always strictly comparable in respect to season, in some cases representing but a single month, so that in a few instances there is no clue to the amount and character of the seasonal variation in color. In a number of instances, however, the series from a single locality includes specimens in both winter and summer pelage, and often specimens in changing pelage. Less than a dozen specimens

represent the period from December 1 to May 1, and these are nearly all *Tamias dorsalis* from Arizona, and *Tamias hindsii* from Northern California. This, however, is not strange, since the various forms of *Tamias* hibernate for a longer or shorter period, according to the locality, in winter. The month of May is represented by 58 specimens; June by 117; July by 68; August by 66; September by 63; October by 78; November by 17. Consequently about nine-tenths of the specimens are in summer pelage, and thus fairly comparable as regards season, four-fifths having been collected between June 10 and November 1. The April, May, and many of the June specimens are in winter coat, but show occasionally traces of the summer pelage; some of the May, and many of the June specimens are changing, and are consequently highly instructive. In general the evidence in hand indicates that there is marked seasonal change in color in all of the forms here considered.

*Seasonal Variation in Color.*—In the preceding article (pp. 41-44) attention has been called to the striking seasonal variation in color in our common eastern Red Squirrel (*Sciurus hudsonius*), where even the pattern of coloration undergoes great change in the transition from winter to summer pelage, and *vice versa.* In the Ground Squirrels (genus *Tamias*) the seasonal change of color is less marked, affecting mainly the tints and not the pattern, which remains constant. Yet the change is so great from the faded condition of the breeding season—May and June—to the fresh bright tints of late summer and early autumn that it would sometimes be difficult to believe that the two phases are simply seasonal conditions of the same animal, were it not that certain specimens of the series were collected during the season of moult, and thus show both conditions in the same individual, the new coat with its bright tints appearing as patches interspersed with the old. Otherwise May and September specimens of the same species might easily be regarded as representing distinct species.

The process of change is evidently so gradual as to usually occupy several weeks; it also occurs earlier or later in different individuals at the same locality, so that specimens may be taken, the same day and at the same place, some of which will be in the

bleached pelage just preceding the moult, and others in the fresh, post-breeding dress, showing little or no trace of the faded breeding dress. In this way, were it not for intermediate examples showing the change in progress, or in the case of limited material with such examples absent, one might easily be misled into a theory of dimorphism to account for the two phases often met with in a large June or July series of specimens.

The moult occurs, in females, mainly after the close of the nursing period, and may thus be delayed by late parturition. The season of moult also varies with locality, and perhaps somewhat with the species. In New Mexico, as shown by a series from San Pedro, the change occurs in May, and is completed before July 1; in the mountains of Central Arizona it occurs mainly in June, covering the period from about the middle of May to the middle of July; in Colorado and British Columbia it seems to be at its height in July.

The young resemble in coloration the post-breeding phase of the adults; in the half-grown young the pelage is thin and silky, and the colors rather dull; but as the season advances the coat thickens and the tints brighten, so that by September the young of the year are generally indistinguishable in color from the adults, and differ from them only in slightly smaller size.

In the young the tail is narrower and more thinly haired than in the adults; the same is true of the tail soon after the moult, in August and September, the tail becoming fuller and more bushy as the coat thickens later in the season. Hence season and condition must be considered in allowing the fullness or slenderness of the tail to have weight as a diagnostic feature.

*Cranial Characters.* — The size and form of the skull vary much with age in all the forms, the skull continuing to thicken and increase in size after the animal has practically attained maturity. This is especially the case with the auditory bullæ, well illustrated in the series of skulls of both *T. dorsalis* and *T. merriami*, in both of which the bullæ are normally very large in comparison with other forms. In these two species the skull (especially the dentition) is heavily developed, strongly in contrast with the thin papery skull of *T. hindsii* and other allied large forms.

There is some variation in respect to the general form of the skull, the proportion of width to length varying in the different forms from .53 to .60—this difference scarcely exceeding the individual variation in a series of ten skulls of *T. dorsalis.* A similar variation is seen in respect to the relative length of the nasal bones, in which also there is too much individual variation to render the average difference between any two forms of much diagnostic importance. There is also some variation in respect to the posterior extension of the nasals in reference to the fronto-premaxillary suture; but here again a series of some twenty skulls of *T. macrorhabdotes* covers the full range of variation presented by all of the forms collectively. Hence it has proved impracticable to make much use of cranial characters as a basis for specific distinctions.

The table of measurements given beyond (p. 67) shows in a general way the size, length of nasals, relative proportion of breadth to length, etc., of average full-grown skulls.

*Classification and Geographical Distribution.*—The material in hand seems to require the provisional recognition of not less than twenty-four forms, of which thirteen are here for the first time described. This material, while apparently so abundant, is in reality too limited to render the present survey of the field more than a superficial reconnoissance, owing to the small number of localities represented, and generally their wide separation, leaving large and very important areas wholly unrepresented. Consequently each locality presents a phase or form more or less peculiar to itself. The forms from distant points are thus unconnected by intermediates, and stand out more or less sharply from their nearest allies. This is presumably due, in not a few cases at least, to the absence of specimens from intervening areas; but some of the forms have in effect, in consequence of physiographic conditions, a truly insular habitat, and must be treated as fully segregated species. On the other hand, several of the forms from the great Rocky Mountain plateau must almost of necessity intergrade more or less fully, but how and at what points cannot at present be determined. It is also quite evident that several additional forms must exist in some of the at present unknown areas of the continent, the relation of which to those

already known can be only conjectured. In a diagram on a subsequent page is indicated what appears to be the probable relationships and lines of intergradation of the several forms (see p. 63).

Even the most nearly related of the phases here recognized are easily distinguished when single average specimens are compared, but the differences become cumulative in effect when series are compared. Yet it is difficult to clearly indicate these differences in words, so that the various forms, even when quite distinct, can be identified from a description. This indeed may be true where the forms in question are beyond doubt specifically separable.*

The difficulty of drawing up a distinctive diagnosis is due to the almost exact similarity in the pattern of coloration running throughout the group, leaving as characters only differences of size, the relative size of the ears and tail, distinctness of markings, and tones of color, all, of course, more or less subject to individual variation, and more or less affected by age and season.

The difference in size between the largest and smallest members of the group is about thirty-three per cent. of the average for the group, as regards linear measurements; while in respect to bulk and weight, the largest forms exceed the smallest by at least three-fold. The length of the tail, as compared with the length of the head and body, varies from .65 to .87. The size of the ear is equally variable, independently of the general size of the animal. These variations, variously combined with differences of color, form the differences characterizing the various forms.

An average member of the group has the dorsal surface marked with five dark and four light longitudinal stripes, and on each side of the head are three dark and three light stripes; the general color above is some shade of gray, more or less suffused with yellowish or rufous, with the flanks washed more or less heavily with some shade of rufous; the ears are more or less distinctly tricolor externally—rufous on the front edge, whitish on the posterior border, and blackish centrally and at the base; behind each ear, on the sides of the nape, is a light patch, varying greatly in size, lightness, and sharpness of definition. The tail pattern is the

* For example, I myself mistook for *Tamias macrorhabdotes* what is below named *T. speciosus*, and I find others have made the same mistake, as shown by the labels on various specimens of *T. speciosus*, yet no two forms of the group are more distinct than these.

same in all—above mixed blackish and light, the hairs individually black at the extreme base, then ringed more or less broadly with buff or rufous, followed by a broad zone of black, and tipped with whitish or yellowish; below with a central area of some shade of rufous, bordered with a broad line of black and a whitish or yellowish external fringe.

From this average type the variations seem interminable; the dorsal stripes vary from the utmost sharpness and distinctness to almost complete obsolescence; the outer dark stripe may be well-defined or wholly absent, or merely obsolescent. The ground color above varies from slate gray to rufous, and also to dull yellowish brown; the color of the flanks varies from the brightest golden rufous to dark umber brown, or to a faint wash of buff; the tipping of the tail hairs varies from strong yellowish to pure silvery white. The ventral surface of the body varies from snow-white to orange buff; and so on in respect to every feature of coloration, the variations being mainly of tone and degree of intensity. It can thus be seen that while two forms may strike the eye as widely different, it may be a difficult matter to clearly convey in words the exact degree and nature of the difference.

From the extreme susceptibility of this plastic group to the influences of environment, it is one of the most instructive and fascinating groups among North American mammals. No one can doubt its comparatively recent differentiation from a common stock, and its dispersion from some common centre. Whether the type originated at some point in North America, or in the northern part of Eurasia, it is perhaps idle to speculate, but that it has increased, multiplied, spread, and become differentiated to a wonderful degree in North America is beyond question; as it is found from the Arctic regions to the high mountain ranges of Central Mexico, and has developed some twenty to thirty very palpable local phases. Some of them easily take rank as species, others as subspecies. Probably a more striking illustration of evolution by environment cannot be cited.

In treating this group of forms certain general facts must evidently be borne in mind: their eminently sedentary habits; their dependence upon the presence of scrub or forest growth, preferably coniferous in character; their habit of hibernation;

and especially the great physiographic diversity of the area covered by the general habitat of the group. Three or four of the forms inhabit the bad-lands, sparsely wooded ravines, and cañons of the interior Great Basin and the Plains; several are confined respectively to isolated mountain ranges; others to the Pacific coast belt. The State of California, extending through 800 miles of latitude, with numerous sharply contrasted physiographic regions, has apparently no less than six strongly differentiated forms, while the region east of the Rocky Mountains, from a little below the northern boundary of the United States northward to the limit of trees—a slightly diversified region of at least ten times the area of California—has only one.

The status of several of the California forms here recognized, and their distribution, cannot be satisfactorily made out, owing to the character and sources of the material, it being nearly all from a few limited areas, and collected either in the months of June or October; only one seasonal phase of pelage is generally represented from any one locality; while in some instances distant localities are represented, the one by June specimens only, and the other exclusively by July to October specimens. In this way the difficulties of the case are greatly complicated.

In this connection a word or two in further explanation of the conclusions here reached, with special reference to my former revision of the group some fifteen years ago, may not be out of place. At that time it was generally presumed that the exploration of the Great West had been carried far enough to bring to light nearly all its forms of mammal life, and to reveal the leading facts of their distribution and environment, and that little more was to be done than to fill in the details respecting their distribution. Doubtless most of the leading writers of that day on North American mammals and birds had great confidence in the finality of their work. What a commentary on that conceit are the revelations, in both these fields, of the last five years! Only within the latter part of this period have we come to realize the meagreness and inexactness of the information which previously had proved so satisfying. We are beginning to realize our ignorance, and gather, catalogue, and label with some minuteness the facts illustrative and explanatory of the great problem of the

evolution of animals by environment. To give point to this little homily, it is only necessary to cite the group of Ground Squirrels here under consideration. Of *twelve* of the twenty-four forms here recognized not a specimen was extant in any collection, public or private, so late as *five years ago!* Nor were any specimens of *Tamias* known from the areas these forms inhabit. Five more of these twenty-four forms were each represented in the material before me in 1877 by from one to four imperfect specimens, so poor in quality that their real character was only made apparent by the acquisition of better material from the same localities. That they were more or less peculiar was then recognized to the extent of treating them as intergrades between the forms they most resembled.

These twenty-four forms fall into several more or less well-marked groups, somewhat as follows:

I. The *hindsii* group, consisting of (1) *T. hindsii* of the coast region of Northern California; (2) *T. townsendii*, of the coast region of Washington and British Columbia; (3) *T. macrorhabdotes* of the Sierra Nevada in Placer County; (4) *T. senex*, of the eastern slope of the Sierra, from Placer County northward to Fort Klamath; (5) *T. quadrimaculatus*, of the Sacramento Valley, California, northward to Fort Klamath; (6) *T. merriami*, of the mountains of Southern California. These are the largest forms, the more southern one (*merriami*) being the largest of the whole group here under consideration. It is possible that *T. senex* and *T. quadrimaculatus* may prove to be seasonal phases of the same species, though, judging by analogy from other species, this seems highly improbable.

II. The *dorsalis* group, consisting of (1) *T. dorsalis* of the desert regions of Utah and Arizona, and (2) *T. obscurus* of Lower California.

III. The *umbrinus* group, consisting of (1) *T. umbrinus* of the Wahsatch and Unitah Mountains; (2) *T. cinereicollis*, of the Mogollon Mountains of Central Arizona; (3) *T. bulleri* of the Sierra Madre of Central Mexico.

IV. The *quadrivittatus* group, consisting of (1) *T. quadrivittatus* of the central portion of the Rocky Mountains (Colorado and

probably Wyoming); (2) *T. luteiventris*, of the Rocky Mountains in Montana; (3) *T. affinis*, of British Columbia, east of the Cascades; (4) *T. neglectus*, of the region immediately bordering Lake Superior; (5) *T. borealis*, of the great wooded plateau region east of the Rocky Mountains, from near the northern boundary of the United States northward; and (6) possibly also *T. gracilis*, of the mountains of Central New Mexico. The last two, however, are much less closely related to *T. quadrivittatus* than are the others.

V. The *minimus* group, consisting of *T. minimus** of the plains of the Upper Missouri, Yellowstone, and Upper Green Rivers; (2) *T. consobrinus*, of the semi-wooded region of the eastern border of the Great Basin; (3) *T. pictus*, of the Great Basin at large. These three forms are the smallest of the group; they are only about one-third to one-half the size (as regards bulk and weight) of the species of groups I and II.

VI. The *frater* group, consisting of (1) *T. frater* of the Sierra Nevadas of Central California; (2) *T. amœnus*, occurring with the last and northward to Fort Klamath. These two species greatly resemble each other, but differ in size and in some other features. Additional material may show that they are only subspecifically separable.

*T. speciosus* is a rather isolated species, more closely resembling *T. frater* than any other form. *T. asiaticus* has no close affiliation with any of the American forms.

The geographical distribution of these forms and their relation to the leading physiographic features of the portions of the continent that the group as a whole occupies, may be thus briefly presented, beginning at the northward:

1. *Tamias quadrivittatus borealis.*—This form appears to occupy the region bounded north by the limit of trees, and west by the Rocky Mountains, whence it extends eastward nearly or quite to Hudson's Bay, and southward to about the northern boundary of the United States, with isolated colonies in the mountains as far south as the Black Hills in South Dakota. The specimens from

* *Tamias asiaticus palidus* of my former monograph=*T. minimus* Bach., 1837.

British America are few, but from widely separated points, as Forts Simpson and Liard, at the eastern base of the Rocky Mountains, the Mackenzie River District, Nelson River, and thence southward to Pembina, and the Turtle and Bear's Paw Mountains. It is a form of medium size and dull, rather dark coloration, confined apparently to well-wooded districts.

2. *Tamias quadrivittatus neglectus.*—This form seems restricted to the very heavily forested region bordering Lake Superior, occurring along its eastern border in Ontario, in the northern peninsula of Michigan, in Northern Wisconsin, and in Northeastern Minnesota. Its range to the northward, and its relationship to *borealis*, remain undetermined, though it would seem that the two forms must somewhere intergrade. It is characterized by the intensity and depth of its tints. While it probably intergrades with *borealis* to the northward, it is entirely cut off from all of the other forms by a broad region of prairies and plains where no form of the *Tamias quadrivittatus* group occurs.

3. *Tamias quadrivittatus affinis.*—This highly-colored form is at present known only from the well-wooded interior of British Columbia, east of the Cascades. How far it extends either north, south, or east is unknown, as is also its relationship to the form occurring in the Rocky Mountains to the eastward, there being no material from the intervening region. To the southward and westward it is replaced by very different forms.

4. *Tamias quadrivittatus luteiventris.*—This is the form of the main chain of the Rockies in Northern Montana. How far it extends northward into British America there is no material to show. It is a forest form, of deep colors, and distinctively characterized by a strong fulvous wash over the ventral surface. It is based on a series of specimens from Chief Mountain Lake, with which specimens from Mystic Lake also agree. Specimens from Helena, Montana, are not quite the same, though referred to it, having also fulvescent underparts, but paler sides and grayer upperparts.

5. *Tamias quadrivittatus.*—This form was originally based on specimens collected in Colorado, in the mountains at the head of the Arkansas River, and seems to prevail throughout the main

chain of the Rockies in Colorado. Specimens from the same chain further north in Wyoming, including the Yellowstone Park region, are somewhat different, though apparently much better referable here than to *luteiventris*. The specimens, however, are few and poor in quality. The region is about equally isolated from the habitat of both *luteiventris* and *quadrivittatus* by breaks in the continuity of the physical features.

A small series from the outlying Laramie range in Eastern Wyoming is also different from any specimens from elsewhere, but in the absence of proper material the series is provisionally referred to *quadrivittatus*.

The still more isolated Big Horn Mountains of Northern Wyoming are unrepresented. Whether the form occurring there will be referable to *borealis* or require separate recognition is thus a matter of conjecture.

6. *Tamias quadrivittatus gracilis.*—This is a slender, bright colored form of the main Rocky Mountain chain, occurring in Central New Mexico, more different from true *quadrivittatus* than any of the preceding forms except *borealis*. Specimens from Apache County, Arizona, are quite similar, so it is probable that the form inhabiting the intervening mountains in northwestern New Mexico may be also referable here—a point not now determinable from lack of specimens.

7. *Tamias umbrinus.*—This is a very large heavily-colored form of the well-wooded Uintah and Wahsatch ranges, forming the eastern border of the Great Basin. It is very different from any of the Rocky Mountain forms, with which there is no possibility, owing to the isolated nature of its habitat, of its direct intergration. The same is true in respect to its relationship to other mountain forms to the southward and northward.

8. *Tamias minimus.*—This is one of the very small, pallid, desert forms, which, so far as the present material goes, cannot be said to intergrade with any other, though it would seem, from its distribution, that it might intergrade with *borealis*, as it probably also does with the other small desert forms of the Great Basin. This form occupies the plains from (probably) the Saskatchewan region southward, and westward to the Rocky

Mountains, inclosing within its range colonies of *borealis*, occupying isolated wooded mountains rising abruptly from the plains, as the Turtle Mountains, Black Hills, etc. At the southwestward, in Southern Wyoming, it crosses the broad forestless depression of the main divide separating the drainage areas of the North Platte and Green Rivers, spreading over the sage plains of the upper Green River basin. It is here cut off on the west and south by the well-wooded ranges of the Wahsatch and Uintah chains. It thus extends across and cuts in two the habitat of *T. quadrivittatus*, if the forms inhabiting the Laramie chain and the Yellowstone Park region be referred to that species.

9. *Tamias minimus consobrinus.*—This form inhabits the foothills and edges of the plains bordering the Uintah and Wahsatch ranges, and thence appears to extend southward and eastward over the half-wooded region of western and southwestern Colorado to the San Luis Valley. Specimens from old Fort Massachusetts, in Southern Colorado, are certainly not satisfactorily distinguishable from those from about Salt Lake City and Fort Bridger. Much more material is necessary to definitely establish the boundaries of its habitat. It is of about the size of *minimus*, but is not nearly so pallid, differing markedly from it in coloration. Though found with *umbrinus* at certain localities, and to some extent resembling it in its tones of color, it differs from *umbrinus* in such a manner as to render their intergradation wholly improbable.

10. *Tamias minimus pictus.*—This is a small, pale, desert form of the Great Basin, differing from all others in the slate gray tint of the general coloration above, its sharply contrasted dorsal streaks, and almost entire absence of the usual wash on the flanks. It ranges from the sage plains of the Columbia River, in Washington, southward to Central Utah and Southern Nevada, and as far east as the northern end of Great Salt Lake. Over how much of this general area it occurs cannot now be stated, owing to lack of material.

11. *Tamias dorsalis.*—This is a large, gray, desert form, occupying the interior arid region, from Northern Utah southward to at least the Mexican boundary, and probably much beyond it, and

from southwestern New Mexico westward to the southeastern border of California. It differs from the other pallid forms (one of which it overlaps in distribution) in being twice their size, in having a heavy, bushy, instead of a slender, narrow tail, and in the dorsal streaks being nearly obsolete. It ranges but a short distance up the slopes of the wooded mountains of Central Arizona, which form the home of a wholly isolated species of very marked characteristics.

12. *Tamias obscurus.*—This form, known at present only from the San Pedro Martir Mountains of Lower California, is a large form with the dorsal streaks very nearly obsolete. It is closely related to *T. dorsalis*, but seems to be too different to be specifically united with it.

13. *Tamias cinereicollis.*—This is a large, very strongly colored form of the heavily wooded mountains of Central Arizona, wholly isolated, as regards its habitat, from any of the other mountain forms.

14. *Tamias bulleri.*—This is a geographically widely separated form of the Sierra Madre Mountains of Central Mexico. Its closest resemblance is to *cinereicollis*, with which, however, intergradation can scarcely be expected on any grounds.

15. *Tamias merriami.*—This is the largest member of the group, well characterized by its very peculiar coloration and relatively very long tail. Its habitat is the sparsely wooded San Bernardino Mountains and neighboring ranges in Southern California, westward and northward into Monterey County.

16. *Tamias speciosus.*—This is a peculiar form, of medium size, differing strongly in various features from all others. It occurs in the San Bernardino Mountains of Southern California, sharing its habitat with *T. merriami.*

17. *Tamias frater.*—This is a rather bright-colored, medium-sized, short, bushy-tailed species of the central portion of the Sierra Nevada, California, most of the specimens in hand being from Placer County and the neighboring mountain region to the eastward in Nevada. It much resembles the next in coloration, and the two forms may intergrade.

18. *Tamias amœnus.*—This is a very small form of the Sierras of Central California and Nevada (Lake Tahoe district), northward at least as far as Fort Klamath. It is quite as small as the small desert forms, but has otherwise no close resemblance to them. Specimens from Lassen and Shasta Counties, California, seem to indicate its habitat as the eastern slope of the wooded Sierra Nevada and Cascade ranges. How far northward in the latter it extends cannot be determined, since there are no specimens available from any part of the Cascades north of Fort Klamath.

19. *Tamias senex.*—This is a large gray form of the Sierra Nevada of Central California, to which a single specimen from Fort Klamath, Oregon, is distinctly referable. Further than this its distribution cannot be defined. It occurs with the last in the Lake Tahoe district. Only May and June specimens are available for examination, the post-breeding pelage being unrepresented. It is apparently quite different from the next, which it adjoins in habitat.

20. *Tamias macrorhabdotes.*—This very distinct, easily characterized form has, so far as known, a very limited habitat, all of the numerous specimens known (except one from Carson City, Nevada) being from Blue Cañon, on the western slope of the Sierra Nevada, in Placer County, California. As now known it has no close relationship with any other form, though it may eventually prove to intergrade with the next.

21. *Tamias quadrimaculatus.*—This form is thus far known from only a few specimens, mostly in bad condition, from the Sacramento Valley, California, from Michigan Bluff, Sacramento County, northward to Shasta County, and Fort Klamath, Oregon. It is the reddest of all the forms; has very large ears and a white-edged tail.

22. *Tamias townsendii hindsii.*—This is a southern form of *T. townsendii*, confined to the heavy rain-fall belt of the coast of California, from San Francisco northward into Oregon. It is characterized by a rufous instead of yellowish suffusion of the dorsal surface.

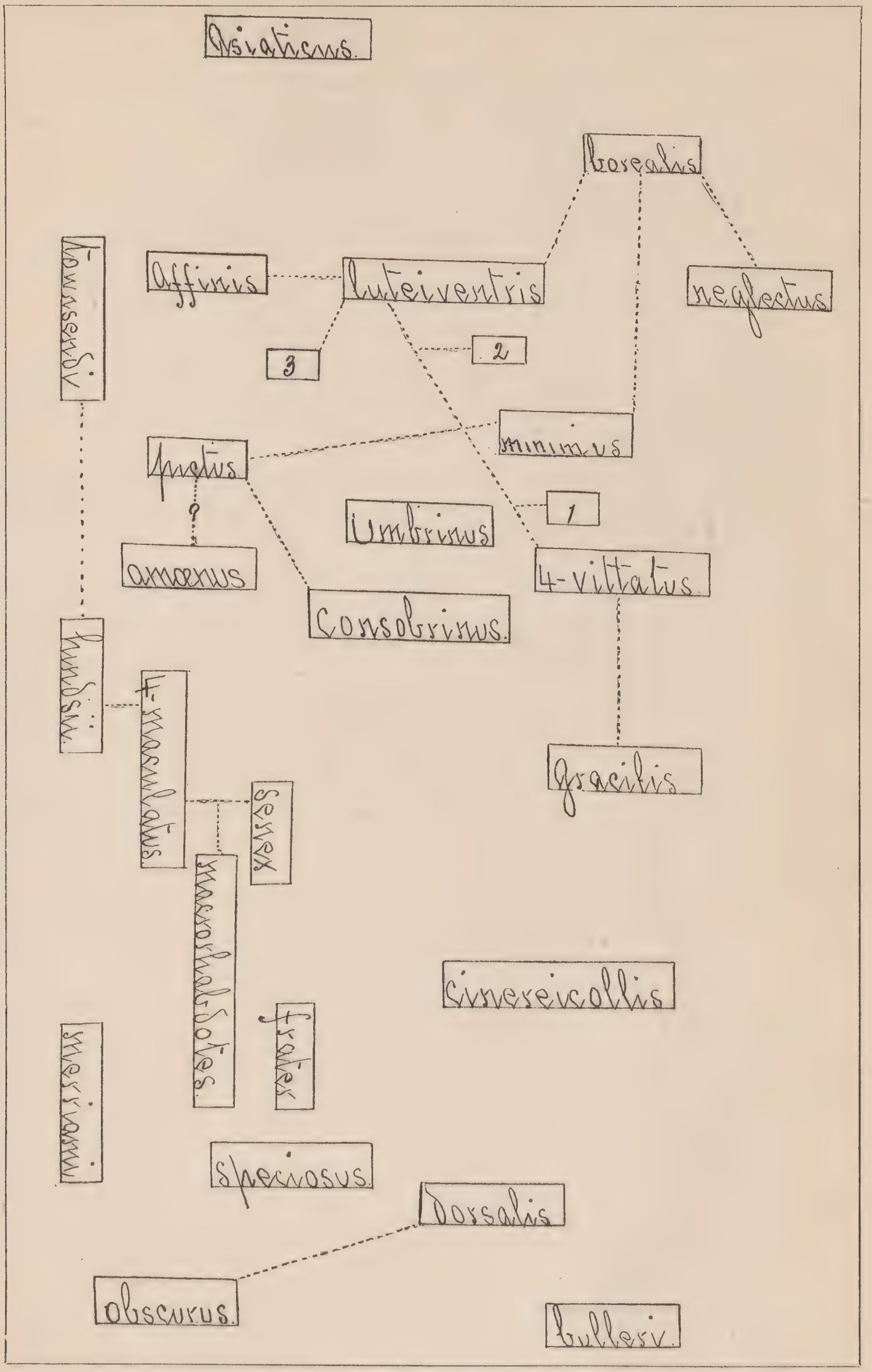
23. *Tamias townsendii.*—This is the large fulvous form of the heavy rain-fall belt of the northwest coast, from Oregon northward to British Columbia, excluding Vancouver Island. It is apparently not found east of the Cascade Mountains. The northern limit of its distribution in British Columbia is not known. Although very different from *hindsii* of Northern California, the two forms probably intergrade, but from lack of specimens from the intermediate districts intergradation is not shown by the material in hand.

The last five form a group of rather closely-related forms, several of which may eventually be found to intergrade.

24. *Tamias asiaticus.* — This Euro-Asiatic form differs markedly from any American form, as shown later on in the present paper. It is also separated from them geographically by a wide area in Northwestern North America, where no form of *Tamias* occur.

The accompanying diagram indicates the status, relationships, and lines of probable intergradation of the forms here considered, so far as can be judged by the material in hand, and also rudely their geographical relations. The forms connected by dotted lines may be found to intergrade, though at no very distant date, geologically speaking, they were doubtless all local forms of a common species, which has become broken up and differentiated in comparatively modern times, through climatic changes and the consequent modifications in the character of the vegetation.

*Diagram of Relationships and lines of probable Intergradation.*




1. Laramie Range, Wyom. 2. Big Horn Mts., Mont. 3. Blue Mts., Oreg.

The following "key" gives the salient features of the various forms of *Tamias* here under consideration, based on average adult specimens, generally in the post-breeding pelage. Owing to the great amount of seasonal variation in color, and of individual variation in this and other features, and of variation in size with age, it is impracticable to attempt the construction of a "key" that will fit all conditions and seasons. The characters given below are to be understood as indicating the average differences shown by a fairly representative series of the forms in question.

*Key to the Species and Subspecies.*

*A.* Very large; total length about 270 mm. (10.50 in.); tail with hairs nearly as long as head and body; dorsal streaks sub-equal and strongly contrasted; *flanks not rufous; head and lower back rufescent, in contrast with the flanks and anterior dorsum* ..... *asiaticus.*

*B.* Very large; total length about 260 to 280 mm. (10 to 11 in.); tail very long, the vertebræ alone equal to about 83 per cent. of length of head and body; ears large, 11 to 14 mm. in length; tail-hairs tipped with white.

*a.* Dorsal streaks distinct.

$a^1$. General color above strong yellowish brown or olivaceous rufous; the light dorsal streaks of the same color as the general ground color; post-auricular patches gray, very small, nearly concealed by surrounding fur ..... *townsendii.*

$b^1$. General color above reddish brown; outer light dorsal streaks more or less whitish, much lighter than the ground color; post-auricular patches white or grayish white, conspicuous ..... *hindsii.*

$c^1$. General color above gray, with a slight yellowish cast; outer light stripes broad, nearly white; post-auricular patches large, light gray, not sharply defined ..... *merriami.*

*b.* Dorsal streaks obsolete.

$a^1$. Median dorsal streak alone distinct; above whitish gray, the hairs broadly ringed subterminally with rusty yellow, which color shows more or less through the gray of the surface; post-auricular patches large, clear white, conspicuous; thighs dull rusty yellow, in contrast with the general dorsal surface ..... *dorsalis.*

$b^1$. All of the dorsal streaks obsolete; above gray mixed and suffused with brown; post-auricular patches whitish, not conspicuous; thighs uniform with the general dorsal surface ..... *obscurus.*

*C.* Large; total length about 254 mm. (10 in.); tail vertebræ equal to about .70 of head and body; ears very large, about 14 to 16 mm.; tail hairs conspicuously tipped with white.

*a.* Sides of shoulders and anterior dorsal surface deep reddish brown, in contrast with the gray rump and thighs.

$a^1$. Ears very large; pure white post-auricular patches very large; sides and back dull brownish red ..... *macrorhabdotes.*

$b^1$. Ears and post-auricular patches smaller; sides and back strong rusty red ..... *quadrimaculatus.*

*b.* Sides of shoulders and anterior dorsal surface gray, like the rump and thighs; ears and auricular patches as in the last ..... *senex.*

*D.* Size medium; total length 235 to 250 mm. (about 9.20 to 9.80 in.); tail vertebræ .80 to .87 of head and body; ears of medium size, about 10 to 13 mm.; tail hairs tipped with yellowish; the four light dorsal streaks of about equal breadth.

*a.* Five dark dorsal streaks, the outer pair nearly as well defined as the others, though much shorter.

$a^1$. Sides of neck and nape gray, in strong contrast with the rufous flanks; tail hairs tipped with yellowish. . . . . *cinereicollis.*

$b^1$. Sides of neck and nape more or less suffused with rufous; tail hairs tipped with rusty yellow.

$a^2$. Ventral surface yellowish buff. . . . . *luteiventris.*

$b^2$. Ventral surface white or grayish white.

$a^3$. Size large; flanks orange rufous; central area of tail below deep orange. . . . . *neglectus.*

$b^3$. Size large; sides golden; central area of tail below pale orange. . . . . *affinis.*

$c^3$. Smaller; sides golden; central area of tail below pale orange. . . . . *quadrivittatus.*

$d^3$. Smaller; sides dull yellowish brown; dark dorsal streaks seal brown instead of black (as in the preceding); the light streaks more tinged with yellowish. . . . . *borealis.*

*b.* Only three distinct dark dorsal streaks, the outer pair obsolete or absent.

$a^1$. Tail hairs tipped with yellowish buff; central area of tail below deep reddish orange; eye-stripe narrow.

$a^2$. Sides of neck and flanks dull umber brown. . . . . *umbrinus.*

$b^2$. Sides of neck and flanks bright golden brown. . . . . *gracilis.*

$b^1$. Tail hairs tipped with gray; central area of tail pale yellowish orange; eye-stripe very broad; sides of neck and body gray, with a small area of rusty chestnut on flanks . . . . . *bulleri.*

*E.* Size medium; total length about 235 mm. (9.20 in.); tail vertebræ about .74 of head and body; ears of medium size (12 mm.), with large clear white post-auricular patches; tail with a conspicuous black tip, both above and below; outer light dorsal streaks pure white, two to three times as wide as the very narrow gray inner streaks. . . . . *speciosus.*

*F.* Size small; total length about 200 to 220 mm. (8 to 8.75 in.); ears variable (8 to 11 mm.).

*a.* Tail short, bushy, about .65 of head and body; ears large (11 mm.).

$a^1$. Smaller; hairs of upper surface of tail pale buff at base, much paler than the central area of the tail below. . . . . *amœnus.*

$b^1$. Larger; hairs of upper surface of tail strong reddish orange at base, much redder than the central area of the tail below . . . . . *frater.*

*b.* Tail long, narrow, .73 to .86 of head and body.

$a^1$. Sides of body dull strong umber brown; dark dorsal streaks dark seal brown; tail long, .86 of head and body. . . . . *consobrinus.*

$b^1$. Sides of body chocolate brown; dark dorsal streaks dull yellowish brown; tail short, about .73 of head and body. . . . . *minimus.*

$c^1$. Sides slate gray, faintly buff on middle of body; dark dorsal streaks seal brown, nearly black; tail medium, about .80 of head and body. . . . . *pictus.*

*External Measurements.**

| | Total length. | | Head and body. | | Tail vertebræ. | | Tail to end of hairs. | | Hind foot. | | Height of ear. | | Perct. of tail vert. to head and body. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mm. | In. | Mm. | In. | Mm. | In. | Mm. | In. | Mm. | In. | Mm. | In. | |
| Tamias merriami | 285 | 11.13 | 140 | 5.51 | 117 | 4.61 | 146 | 5.75 | 34 | 1.34 | 13 | .51 | 83 |
| " asiaticus* | 271 | 10.58 | 146 | 5.75 | 100 | 3.94 | 125 | 4.92 | 35 | 1.38 | 10 | .39 | 69? |
| " senex* | 264 | 10.31 | 146 | 5.75 | 98 | 3.86 | 118 | 4.65 | 35 | 1.38 | 14 | .55 | 67? |
| " townsendii hindsii | 264 | 10.31 | 133 | 5.24 | 110 | 4.33 | 131 | 5.16 | 34 | 1.34 | 11 | .43 | 83 |
| " townsendii | 257 | 10.33 | 131 | 5.16 | 107 | 4.21 | 126 | 4.96 | 34 | 1.34 | 12 | .47 | 82 |
| " macrorhabdotes | 260 | 10.03 | 134 | 5.67 | 97 | 3.82 | 126 | 4.57 | 34 | 1.34 | 16 | .63 | 72 |
| " dorsalis | 253 | 9.96 | 125 | 4.92 | 104 | 4.10 | 132 | 5.20 | 33.5 | 1.32 | 14 | .55 | 83 |
| " bulleri* | 250 | 9.84 | 127 | 5.00 | 98 | 3.86 | 125 | 4.92 | 33.5 | 1.32 | 12 | .47 | 77 |
| " umbrinus | 249 | 9.80 | 125 | 4.92 | 100 | 3.94 | 124 | 4.88 | 32 | 1.26 | 10 | .39 | 80 |
| " cinereicollis | 247 | 9.73 | 121 | 4.73 | 101.5 | 4.00 | 126 | 4.96 | 35 | 1.38 | 13 | .51 | 84 |
| " quadrimaculatus* | 249 | 9.80 | 134 | 5.28 | 93 | 3.66 | 115 | 4.53 | 30 | 1.18 | 14 | .55 | 70 |
| " quadrivittatus affinis* | 245 | 9.65 | 125 | 4.92 | 95 | 3.74 | 120 | 4.73 | 31.5 | 1.24 | 10 | .39 | 78 |
| " quadrivittatus luteiventris | 243 | 9.57 | 128 | 5.04 | 93 | 3.66 | 117 | 4.60 | 33 | 1.30 | 11.5 | .45 | 73 |
| " speciosus | 234 | 9.21 | 123 | 4.84 | 91 | 3.58 | 111 | 4.37 | 32 | 1.26 | 12 | .47 | 74 |
| " obscurus* | 230 | 9.06 | 125 | 4.92 | 80 | 3.15 | 105 | 4.13 | 32 | 1.26 | 12 | .47 | 74 |
| " quadrivittatus gracilis | 235 | 9.27 | 115 | 4.53 | 100 | 3.94 | 120 | 4.73 | 31 | 1.22 | 12 | .47 | 87 |
| " quadrivittatus borealis | 230 | 9.06 | 113 | 4.45 | 99 | 3.90 | 117 | 4.62 | 31 | 1.22 | 9 | .36 | 87 |
| " quadrivittatus | 223 | 8.78 | 115 | 4.53 | 82 | 3.23 | 108 | 4.25 | 31 | 1.22 | 10 | .39 | 71 |
| " quarivdittatus neglectus* | 225 | 8.86 | 115 | 4.53 | 90 | 3.54 | 110 | 4.33 | 30 | 1.18 | 9 | .36 | 78? |
| " frater | 225 | 8.78 | 119 | 4.68 | 77 | 3.03 | 97.5 | 3.84 | 32 | 1.26 | 11 | .43 | 65 |
| " amœnus | 207 | 8.15 | 116 | 4.57 | 70 | 2.76 | 91 | 3.58 | 30 | 1.18 | 11 | .44 | 67 |
| " minimus consobrinus | 214 | 8.43 | 103 | 4.06 | 90 | 3.54 | 111 | 4.37 | 29.5 | 1.16 | 9 | .36 | 87 |
| " minimus pictus | 210 | 8.37 | 110 | 4.33 | 89 | 3.50 | 109 | 4.29 | 29 | 1.14 | 8 | .32 | 81 |
| " minimus | 202 | 7.95 | 117 | 4.61 | 85 | 3.35 | 106 | 4.17 | 29 | 1.14 | 8 | .32 | 73 |

* The measurements here given are averages, based on measurements taken by the collector before skinning, of generally 8 to 20 or more specimens, except where the names are marked with an asterisk, where the measurements are based on skins, and must be considered as only approximate.

*Measurements of the Skull.**

| | Total Length. | | Greatest Width. | | Per cent. of width to length. | Length of nasals. | | Length of upper molar series. | |
|---|---|---|---|---|---|---|---|---|---|
| | Mm. | In. | Mm. | In. | | Mm. | In. | Mm. | In. |
| Tamias dorsalis | 41.7 | 1.64 | 22.8 | .90 | 55 | 12.2 | .48 | 6.4 | .25 |
| " merriami | 40.9 | 1.61 | 23.6 | .93 | 58 | 12.7 | .50 | 6.9 | .27 |
| " townsendii hindsii | 40.0 | 1.56 | 22.4 | .88 | 57 | 11.9 | .47 | 5.8 | .23 |
| " townsendii | 38.6 | 1.52 | 22.1 | .87 | 57 | 11.2 | .44 | 6.1 | .24 |
| " quadrimaculatus | 38.9 | 1.53 | 22.1 | .87 | 56 | 11.9 | .47 | 6.1 | .24 |
| " macrorhabdotes | 38.1 | 1.50 | 20.6 | .81 | 54 | 12.7 | .50 | | |
| " senex | 37.6 | 1.48 | 21.1 | .83 | 53 | 12.5 | .49 | 5.8 | .23 |
| " obscurus | 38.1 | 1.50 | 20.3 | .80 | 53 | 11.9 | .47 | | |
| " bulleri | 37.6 | 1.48 | 20.8 | .82 | 53 | 11.9 | .47 | 6.6 | .26 |
| " cinereicollis | 37.3 | 1.47 | 20.7 | .81 | 53 | 12.2 | .48 | 5.6 | .22 |
| " umbrinus | 37.1 | 1.46 | 19.5 | .77 | 53 | 10.9 | .43 | 5.1 | .20 |
| " quadrivittatus gracilis | 36.1 | 1.42 | 19.0 | .78 | 55 | 11.4 | .45 | 5.3 | .21 |
| " speciosus | 35.0 | 1.38 | 19.8 | .78 | 57 | 11.4 | .45 | 5.6 | .22 |
| " frater | 35.0 | 1.38 | 19.6 | .77 | 57 | 10.9 | .43 | 5.1 | .20 |
| " quadrivittatus luteiventris | 33.8 | 1.33 | 19.6 | .77 | 58 | 10.2 | .40 | | |
| " quadrivittatus affinis | 33.8 | 1.33 | 18.4 | .73 | 55 | 10.2 | .40 | | |
| " quadrivittatus borealis | 32.5 | 1.28 | 18.4 | .73 | 57 | 10.4 | .41 | 5.3 | .21 |
| " quadrivittatus | 32.8 | 1.29 | 18.3 | .72 | 56 | 10.2 | .40 | 5.3 | .21 |
| " amœnus | 32.3 | 1.27 | 18.4 | .73 | 58 | 9.0 | .35 | 4.6 | .18 |
| " minimus | 31.8 | 1.25 | 19.0 | .75 | 60 | 10.2 | .40 | 5.1 | .20 |
| " minimus consobrinus | 30.5 | 1.20 | 17.3 | .68 | 57 | 9.4 | .37 | 4.8 | .19 |
| " minimus pictus | 30.0 | 1.18 | 17.0 | .67 | 57 | 9.0 | .35 | 4.6 | .18 |

* Based on single average fully adult specimens.

## Tamias dorsalis.

(GILA CHIPMUNK.)

*Tamias dorsalis* BAIRD, Proc. Acad. Nat. Sci. Phila., VII, 1855, p. 332; Mam. N. Am., 1857, p. 300, pl. xlvi; U. S. and Mex. Bound. Surv., II, pt. ii, 1859, p. 37.—GRAY, Ann. and Mag. Nat. Hist., 3d ser., XX, 1867, 436.—COUES, Amer. Nat., I, 1867, p. 358; Proc. Acad. Nat. Sci. Phila., 1867, p. 134.

*Tamias quadrivittatus*, var. *dorsalis* ALLEN, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 290.

*Tamias quadrivittatus dorsalis* COUES & YARROW, Wheeler's Rep. Geogr. Expl. and Surv. West of 100th Merid., V, 1876, p. 119.

*Tamias asiaticus*, var. *dorsalis* ALLEN, Mon. N. Am. Roden., 1877, p. 794.

*Tamias quadrivittatus pallidus* COUES & YARROW, Wheeler's Rep. Geogr. Expl. and Surv. West of 100th Merid., V, 1876, p. 118 (specimen examined).

*Hab.*—Great Basin, from Northern Utah southward to Mexico, west to the Sierra Nevada Mountains, east to the Mimbres in New Mexico.

*Autumnal Pelage* (Sept.–Dec.).—Coat very soft and thick. Above whitish gray, varied with black hairs, and with a faint vinaceous cast, due to the color of the underfur showing through the whitish general surface, the hairs being broadly ringed subterminally with tawny; ventral surface soiled white, the fur plumbeous at the base; sides, at the junction of the dorsal and ventral areas, dull yellowish brown (very pale, almost obsolete, in some specimens, quite strong in others), extending from the sides of the head to, and including, the hind limbs. Dorsal streaks obsolete, except the single, narrow, half-concealed black median stripe; the four light stripes are indistinctly outlined by slightly darker interspaces, so that rudimentary traces of the usual five dark and four light stripes are, as a rule, faintly outlined. Facial stripes well defined, the light ones very broad, grayish white, the dark ones much narrower, the upper dusky; the eye-stripe pale brown, blackish for a short distance just behind the eye; the lower or malar stripe brownish, slightly varied with dusky, widening and becoming more rufous posteriorly, where it forms a rather broad rusty mark below the base of the ear and the post-auricular patch. Ears rather large, pointed, the front third externally rusty, the posterior third whitish, the intervening triangular space at the base of the ear blackish. Post-auricular patches large, whitish. Tail very broad and bushy, above black varied with white, the hairs being broadly ringed near the base with pale buffy white, with a broad subapical zone of black, and tipped with nearly pure white; below, central area orange rufous, edged and tipped with a broad band of black, fringed with soiled white.

*Breeding Pelage* (April and May).—Generally similar to the autumnal pelage, but all the tints paler, the general color above much more ashy, without the vinaceous effect, the subterminal zone of the underfur narrower, paler, and more yellowish.

*Young.*—Pelage thin, silky. In the young of the year (one-fourth to nearly full grown) the dorsal stripes are all very distinct, quite as much so as in several of the forms of the *quadrivittatus* group. The median dark stripe is often deep black; the middle pair strong rufescent brown, more or less mixed with dusky or even black; the outer pair more faintly indicated, brownish. The middle light stripes are broad, clear whitish gray; the outer pair narrower, often nearly pure white. Sides of body strong yellowish tawny, varying to dull cinnamon; hind feet cinnamon rufous, which color strongly washes the hind legs. As the season advances the coat thickens, the stripes become more and more obsolete, the colors changing by the growth of the new fur, which is lighter at the tips and more broadly ringed with tawny beneath the surface.

*Measurements.*—Length (average from measurements of 12 specimens in the flesh by collectors), 253 mm.; head and body, 125 mm.; tail vertebræ, 104 mm.; tail to end of hairs, 132 mm.; hind foot, 33.5 mm.; height of ear (from skins) 14 mm.

*Specimens examined*, 42; collected as follows: Ogden, Utah, Oct. 9–19, 1888, Vernon Bailey (Coll. C. H. Merriam), 7; Provo, Utah, Nov. 12, 1888 (same collector and collection), 2; Manti, Utah, Dec. 1, 1888 (same), 1; Ogden, Utah, June 14, 1872, Dr. C. H. Merriam (U. S. Nat. Mus.), 1 (young); Santa Catalina Mountains, Arizona, May 29–June 3, 1889, V. Bailey (Dept. of Agric.), 8; Santa Catalina Mountains, Arizona, Nov. 4–6, 1886, W. E. D. Scott (Am. Mus. Nat. Hist.), 4; Grand Cañon, Cohinini Plateau, Arizona, Sept. 14, 1889, Merriam and Bailey (Dept. of Agric.), 2; various localities, Central Arizona, April 21, May 22, June 4, Aug. 11 and 30, Nov. 11–19, Dr. E. A. Mearns (Am. Mus. Nat. Hist.), 11; Prescott, Arizona, Oct. 7, 1889, Dr. L. Stejneger (U. S. Nat. Mus.), 1; same locality and collection, Sept. 8, 1866, Dr. E. Coues, 1; Fort Wingate, New Mexico, Feb. 23, 1887, Dr. R. W. Shufeldt (Nat. Mus.). 1; El Moro, New Mexico, July 23, 1877, H. W. Henshaw (Nat. Mus.), 1; Copper Mines, Gila River, New Mexico, J. H. Clark (Nat. Mus.), 2, including type of the species.

The specimens from Arizona average somewhat larger than those from Northern Utah, as shown by the collector's measurements of the adults in the two series, but they seem not to be otherwise different.

This form is so distinct from all others that it only needs comparison with the next, which is its nearest ally, and with which it may be found to intergrade.

From the dates on the labels it would seem to be active nearly throughout the year, retiring for a brief period during the severest weather. Dr. Mearns informs me that it is preëminently an inhabitant of cañons and rocky country, though ranging upward

into the lower edge of the pine belt in the mountains of Arizona, where it is sometimes found at an altitude of 6500 feet, its habitat, however, not overlapping that of *T. cinereicollis.*

## **Tamias obscurus** *Townsend*, MS.

(Lower California Chipmunk.)

*Tamias obscurus* Townsend, MS.

*Hab.*—San Pedro Mountains, Lower California, Mexico.

*Breeding Pelage* (May).—Pelage very soft and thick. General color above gray, rather darker and browner than in *T. dorsalis ;* subterminal band of underfur browner ; central area of tail below darker, more chestnut brown ; median dark dorsal streak less well defined, distinctly traceable for only a short distance on the middle of the back, in front of the hips. Outer pair of light stripes indistinct, but evident. Thighs and hind legs similar in coloration to back and sides—not tawny, in contrast with back and sides, as in *T. dorsalis.* In other respects similar in coloration to May and June specimens of *T. dorsalis.* Size, however, apparently much smaller.

*Measurements.*—Length (approximate from skins), 230 mm.; head and body, 125 mm.; tail vertebræ, 80 mm.; tail to end of hairs, 105 mm.; hind foot, 32 mm.; height of ear, 12 mm.

Type, No. 18,050, Coll. U. S. Nat. Mus., ♀ ad., San Pedro Mountains, May 1, 1889, C. H. Townsend.

*Specimens examined*, 8 (U. S. Nat. Mus.), San Pedro Mountains, Lower California, April 29–May 6, 1889 ; collected by Mr. C. H. Townsend, who has generously placed them in my hands, under the above manuscript name, for description.

The eight specimens are all adults in the faded pelage of the breeding season, but none of the four or five females among them appear to have been nursing young when killed, the date (about May 1) being perhaps too early for the young to have been born. The series presents considerable individual variation in color, mainly in respect to the amount of brownish suffusion beneath the surface of the pelage, in some it being quite strong and in others nearly absent, in which latter the general color of the dorsal surface is somewhat paler and grayer than in the others.

This species, while evidently closely allied to *T. dorsalis*, may well be treated as distinct, in the light of present material. It is evidently much smaller than *T. dorsalis*, browner in coloration, with the thighs and hind legs uniform with the back, and the

median dorsal stripe obsolete except for a short distance on the lower part of the back. In *T. dorsalis* this stripe, though narrow, is generally well defined from the middle of the crown to the base of the tail; the hind legs and thighs are also tawny, in more or less strong contrast with the color of the back, the reverse of what occurs in *T. obscurus*. The two forms are, however, much more nearly related to each other than are either to any other form.

## Tamias asiaticus.

(SIBERIAN CHIPMUNK.)

*Sciurus striatus* PALLAS, Nov. Glires, 1778, p. 378 (not *S. striatus* of LINN., ex CATESBY).

*Sciurus striatus*, *a. asiaticus* GMELIN, Syst. Nat., I, 1788, p. 150.

*Sciurus uthensis* PALLAS, Zoog. Rosso-Asiat., I, 1831, p. 189 (melanistic).

*Tamais pallasi* BAIRD, Ann. Rep. Smiths. Inst. for 1856 (May, 1857), p. 55; Mam. N. Am., 1857, p. 295.

*Tamias quadrivittatus*, var. *pallasi* ALLEN, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 290 (in part only).

*Tamias asiaticus* ALLEN, Mon. N. Am. Roden., 1877, p. 793 (in part only).

*Tamias asiaticus*, var. *borealis* ALLEN, *ibid.*, p. 793 (in part—only the Old World specimens and references).

*Hab.*—Siberia; from the east coast westward to the White Sea and Dwina River.

General color above pale yellowish gray, passing into dull dark rufous on the head and lower part of the back and thighs; sides of body only slightly or not at all more suffused than the middle of the dorsal region. Dorsal dark stripes five, black, a little broader than the lighter interspaces, the three median ones extending from the nape to the base of the tail, the outer pair nearly as broad and distinct as the others, and nearly as long, extending from the middle of the shoulder to a point a little posterior to the acetabulum. Middle pair of light stripes white, suffused more or less with fulvous or rufous for their posterior half; outer pair slightly broader than the median ones, whiter, and less suffused posteriorly. Facial stripes very distinct, the light ones grayish white, the dark ones blackish brown, the lower one very broad and strong, broadening posteriorly and continued to the sides of the nape. Below clear white, or pale fulvous white. Tail above mixed black and whitish; central area below pale buffy yellow, edged narrowly with black, with an external broad fringe of white. Ears small, narrow, and pointed.

*Measurements.*—Length, 271 mm.; head and body, 146 mm.; tail with hairs, 125 mm.; hind foot, 35 mm.; height of ear, 10 mm.

*Specimens examined*, 4, "Siberia."—They vary somewhat in color, especially in the amount of rufous on the head and lower back, and probably represent different seasons of the year.

With the material now before me, I consider that the reference of certain American forms of *Tamias* to the Old World *T. asiaticus*, made by me in 1874 and 1877 (l. c.), was hasty and unwarranted. In 1877 I had practically only a single skin of the Siberian Chipmunk, a second example (completing the series) being in too poor condition to be of any value. I now have in addition two mounted specimens (Coll. Am. Mus.) in very fair condition, which show the characters of the species to good advantage.

The Siberian Chipmunk proves to be of about the size and general proportions of *T. townsendii*, with somewhat the general appearance of *T. borealis*, having similar small ears and pale coloration. A close comparison, however, shows it to be a heavier, larger animal than the latter, as shown especially by the size of the feet, and that it also differs in certain features of coloration. The facial dark streaks are more pronounced, especially the lower one. The light dorsal bands are whiter, and the upper surface of the head and the lower back and rump are strongly washed with rufous, in contrast with the general dorsal surface, while there is very little rufous suffusion on the sides. Larger size, and the rufous head and rump, however, form the chief distinctions separating it from *T. borealis*, while the marked difference in coloration easily distinguishes it from *T. townsendii*. In the color of the head and rump it somewhat recalls *T. striatus*, which it also resembles in size; but from which it differs in its very much longer tail, and in the very different character of the dorsal streaks, both in color and extent.

As no form of *Tamias* has as yet been either taken or reported from any part of Alaska, so far as I have been able to ascertain, there is a wide geographical hiatus at present separating *T. asiaticus* from any of its congeners, however the case may have been in comparatively recent times, geologically speaking.

## Tamias townsendii.

(Townsend's Chipmunk.)

*Tamias townsendii* Bachman, Journ. Acad. Nat. Sci. Phila., VIII, 1839, p. 68; also, in part, of Baird, and others prior to 1874.

*Tamias quadrivittatus townsendi* Allen, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 290 (in part).

*Tamias asiaticus townsendi* Allen, Mon. N. Am. Roden., 1877, p. 794 (in part).

*Tamias cooperi* Baird, Proc. Acad. Nat. Sci. Phila., 1855, p. 334; Mam. N. Am., 1857, p. 301.

*Hab.*—Coast region (west of the Cascade Mountains) of Washington and British Columbia, from about the mouth of the Columbia River northward.

*Post-breeding Pelage.*—Above, general color nearly uniform yellowish-olivaceous rufous, the flanks only slightly deeper in tone than the back. Dark dorsal stripes five, black, the median three deep black and broad, the middle one extending from the centre of the crown to the base of the tail, the next on either side beginning at the shoulder and terminating at the base of the tail, the outer much shorter (extending from the posterior border of the shoulder to the hip) and narrow, usually more or less suffused with the ground color, and sometimes obsolete. The median pair of intervening light stripes usually uniform with the general ground color, sometimes slightly lighter; outer pair of light stripes usually barely perceptably lighter than the median pair, but occasionally distinctly grayish, and hence more or less in contrast with the general ground color. Facial markings not strongly contrasted, but of the usual pattern, consisting of a band of yellowish gray above the eye, and another similar band below the eye, the two separated by an ocular stripe of yellowish brown mixed with dusky, the portion in front of the eye usually obsolete; the light superciliary stripe is bordered above with an edging of blackish; the light subocular stripe is bordered below by a yellowish brown malar stripe, mixed with blackish. Ears large, externally blackish, with a broad posterior margin of grayish white; a small grayish spot behind the base of the ear, partly concealed by the surrounding fur. Ventral surface of the body grayish white, often nearly pure white centrally. Tail above black fringed with silvery white, the hairs being dark reddish brown at base, subterminally broadly ringed with black and tipped with white; below, central area bright chestnut, bordered with black, and an outer fringe of white.

*Breeding Pelage.*—Specimens taken in May and June differ only in having all of the tints paler, with the light dorsal streaks grayish, especially the outer pair, which are often pure light gray.

*Young.*—The half-grown young are similar in color to the adults in fall, except that the tints are duller, and the pelage finer and softer. The outer light stripes are, however, much lighter than the ground color.

*Measurements.*—Length, 257 mm.; head and body, 131 mm.; tail vertebræ, 107 mm.; tail to end of hairs, 126 mm.; hind foot, 35 mm.; height of ear, 12 mm. (Measurements, except of ear, from specimens in alcohol, from *Baird*, Mam. N. Am., p. 303).

*Specimens examined*, 44, from the following sources: Mt. Lehman, British Columbia, June 5–15, 1889, Clark P. Streator (Am. Mus. Nat. Hist.), 9; Westminster, B. C., May 15, 1889, C. P. Streator (Am. Mus.), 1; Kalama, Washington, Oct. 15–20, 1889, C. P. Streator (Am. Mus.), 4; Cape Disappointment, Wash., Nov. 1–11, 1889, C. P. Streator (Am. Mus.), 5; Chilliwhack, B. C., April 2, 1882, A. C. Brooks (Coll. Dr. C. H. Merriam), 1; Port Townsend, Puget Sound, Wash., Aug. 27, 1888, Dr. C. H. Merriam (Coll. C. H. M.), 1;

Neah Bay, Wash., Sept. 3, 1888, Dr. C. H. Merriam (Coll. C. H. M.), 1; Pacific County, Wash., March 17 and July 22, 1885, A. H. Helme (Am. Mus.), 3; Fort Steilacoom, Wash., June, 1854, Dr. Geo. Suckley (Nat. Mus.), 1; Cascade Mountains (western slope, lat. 46°), Dr. J. G. Cooper (Nat. Mus.—types of *T. cooperi* Baird), 2; Shoalwater Bay, Wash., Aug. 20, 1855, Dr. J. G. Cooper (Nat. Mus.), 2; Mount Vernon, Wash., Sept 7, 1889, T. S. Palmer (Dept. of Agric.), 2; Aberdeen, Wash., Aug. 10–12, 1889, T. S. Palmer (Dept. of Agric.), 2; Astoria, Oregon, July 25–Aug. 2, 1889, T. S. Palmer (Dept. of Agric.), 8; Astoria, 1885, Lt. W. P. Trowbridge (Nat. Mus.), 1; Elk Head, Oregon, June 29, 1881, A. Todd (Nat. Mus.), 1.

There is no very decided variation with season or locality, the individual variation shown by the larger series from a single locality fully covering the whole range of variation shown by the whole series collectively.

The outer pair of light dorsal stripes are generally appreciably lighter than the median light stripes, but in a few specimens the lateral light stripes are not different in tint from the general ground color. Occasionally the light dorsal stripes are all distinctly lighter than the ground color. The outer pair of dark stripes are sometimes broad and well-defined black bands, but generally they are much narrower and duller than the median bands, being less black and more mixed with brown; occasionally they are almost wholly obsolete, or are represented by a very narrow dusky brown streak. The color of the sides and the general color above varies considerably in intensity, independently of season and locality.

It is noteworthy that there is no admixture of gray in the general dorsal pelage, even on the rump, a feature so characteristic of *T. hindsii* and other allied forms.

The two specimens forming the types of what Professor Baird at one time called *Tamias cooperi* are embraced in the series before me. They "were procured on the west side of the Cascade range of mountains, in Washington Territory," and are the two palest specimens in the series. They are, however, very nearly matched by a specimen from Fort Steilacoom and by two others from near the mouth of the Columbia River. Although without date, they have the faded appearance of specimens taken late in the breading season.

There are no specimens of *Tamias* from any part of the coast region of Oregon south of the vicinity of Astoria; from this

point northward to Mt. Lehman, British Columbia, *T. townsendii* is represented from numerous localities, all situated west of the Cascade Mountains. Here it appears to be the only form of the genus. How far northward it extends along the coast cannot now be determined. It is, however, apparently not found on Vancouver Island, as Mr. Streator did not meet with it there, and was informed by old residents that no Ground Squirrel occurred on the island.

## Tamias townsendii hindsii.

(Redwood Chipmunk.)

*Tamias hindei* [err. typ.] Gray, Ann. and Mag. Nat. Hist., X, 1842, p. 264.

*Tamias hindsii* Gray, List Spec. Mam. Brit. Mus., 1843, p. 145; Zoöl. Voy. Sulphur, I, 1844, p. 34, pl. xii, fig. 1; Ann. and Mag. Nat. Hist., 3d ser., XX, 1867, p. 435 (in part only).

*Tamias townsendii* Baird, Mam. N. Am., 1857 (in part).

*Tamias asiaticus townsendi* Allen, Mon. N. Am. Roden., 1877, p. 794 (in part).—Townsend, Proc. U. S. Nat. Mus., X, 1887, p. 171 (the entry under this name at the *bottom* of the page).

*Tamias asiaticus hindsii* Allen, Bull. Am. Mus. Nat. Hist., II, No. 3, 1889, p. 178.

*Hab.*—Coast region of California, from San Francisco northward. Restricted to the narrow coast belt west of the Coast Range.

*Breeding Pelage* (April and May specimens).—General color above dull dark reddish brown, mixed strongly with gray; brighter red and less gray on the flanks, darker and more mixed with gray on the lower back, rump, thighs, and sides of shoulders; anterior half of the dorsal region much more rufous than the posterior half. Dark dorsal stripes three or five, the outer pair, as a rule, obsolete or barely traceable; the median stripe broad, black, edged and more or less suffused both anteriorly and posteriorly with chestnut rufous; the next on either side shorter, beginning at the shoulders, broad, black, much suffused with rufous toward the anterior end; the outer dark stripe indistinct, often wholly wanting, and generally barely traceable as a slight mixture of blackish hairs along the upper border of the red of the flanks. Median pair of light stripes mixed rufous and gray, the former greatly predominating; outer pair of light stripes whitish, sometimes clear silvery, but generally soiled whitish gray. Facial stripes strongly contrasted, the light supra- and subocular lines whitish gray, often stained on the edges with yellowish; ocular stripe blackish brown edged and mixed with chestnut, well defined in front of the eye, but much broader and darker behind the eye; malar stripe dark chestnut brown, mixed with blackish. Ears narrow, long, the external surface dusky brown on the anterior half, silvery gray on the posterior half, including the apical portion. Post-auricular patches small, whitish gray. Ventral surface of body white,

varying to soiled yellowish white. Tail, above blackish, the hairs ringed broadly with pale chestnut near the base, and subapically with black, the extreme tips silvery white; below, central area dark reddish chestnut, bordered with black, and externally fringed with white.

*Post-breeding Pelage* (July).—General color above cinnamon rufous, stronger and deeper on the sides, *with no admixture of gray.* Median pair of light stripes like the general ground color; outer pair whitish, the hairs white subapically and tipped with pale yellowish rufous. Ventral surface of the body white, usually more or less washed with buff or pale rusty.

From this phase to that of late autumn, in which, as in the April and May specimens, there is a general admixture of gray throughout the dorsal surface (especially posteriorly), the change is very gradual, as is well illustrated by the material now in hand. The gray admixture first appears on the rump and thighs, and gradually extends to the middle of the back, and later over the sides of the shoulders and anterior half of the back, in part replacing the cinnamon hairs, which appear gradually to fall out. Some of the November specimens are thus indistinguishable from others taken in February, March, and April. May specimens are generally somewhat paler. In October specimens there is a strong contrast between the anterior and posterior dorsal regions, a scapular mantle of cinnamon rufous covering the anterior half of the dorsal area, from the middle of the back to the nape, and including the sides of the shoulders, in contrast with grayish dark brown of the lower back, rump, and thighs.

*Young.*—The half-grown young are colored nearly like the adults in the breeding season, except that the tints are duller; the light dorsal stripes are distinctly whitish, in strong contrast with the general ground color. The pelage, as usual in the young, is much finer and softer than in the adults. When nearly full grown they moult into a red phase of pelage similar to the July phase of the adults, as shown by a specimen taken May 18, at Nicasio, in process of change, and having patches of both phases of pelage.

*Measurements.*—Length, 264 mm.; head and body, 133 mm.; tail vertebræ, 110 mm.; tail to end of hairs, 131 mm.; hind foot, 34 mm.; height of ear, 11 mm. (Collector's measurements, taken from the specimens before skinning, except those of hind foot and ear.)

*Specimens examined*, 39, from the following sources: Nicasio, Marin Co., California, Feb. 7, 13, March 13, April 25, 27, May 10, 18, June 30, July 13, 20, Oct. 4, 6, 12, 22, Nov. 2, 11, 23, C. A. Allen (Am. Mus., 9; Nat. Mus., 5; Coll. C. H. M., 4=), 18; Olema, Marin Co., June 10, 1888, W. E. Bryant (Cal. Acad. Sci.), 1; Redwood, Sonoma Co., Oct. 15, 1883, W. E. Bryant (Coll. C. H. Merriam), 1; Redwood, spring of 1856, E. Samuels (Nat. Mus.), 1; Healdsburg, Sonoma Co., Oct. 14, 1888, W. E. Bryant (Cal. Acad.), 1; Cloverdale, Sonoma Co., April 3, 1885, W. E. Bryant (Nat. Mus.), 4; Cahto, Mendocino Co., May 8–11, 1889, T. S. Palmer (Dept. of Agric.), 4; Cahto, May 18, June 4, 11, A. C. McGregor (Cal. Acad.), 3; Humboldt Bay, Hum-

boldt Co., Oct., 1885, C. H. Townsend (Nat. Mus.), 5; Rio Dell, Humboldt Co., May 29, 1889, T. S. Palmer (Dept. of Agric.), 1; Crescent City, Del Norte Co., June 27, 1889, T. S. Palmer (Dept. of Agric.), 1; "Fort Crook, N. Cala., John Feilner" (Nat. Mus.), 1.

The specimens of *T. hindsii* are thus all from the coast region of Northern California, the localities represented being all near the coast, and extend from Marin County north to the northern border of the State. As already stated, there are no specimens of *Tamias* from the coast region of Oregon south of Astoria. Consequently "intermediates," if such exist, connecting this form with *T. townsendii*, are to be expected from this at present unknown region—unknown as regards the *Tamias* question.

The series presents a large amount of seasonal variation, and quite a range of individual variation, in respect to depth of tints. The widest departure from the average or normal condition is the peculiar specimen from the "redwoods....north of Petaluma," Sonoma County, referred to by Professor Baird* as remarkable for its generally dark colors and the obscuration of the streaks, this specimen still remaining unique.

Specimens from different localities present no important differences, except the series of five from Humboldt Bay, which are remarkable for their generally dark deep tone of coloration, being of a dull deep brownish red, many shades darker than any specimens from elsewhere. Unfortunately the skins have been made up from specimens preserved in alcohol (probably methylic), to which fact is most likely due their heightened color.

*Tamias hindsii* was originally based on a specimen almost unquestionably taken in the immediate vicinity of San Francisco, Cal., in the month of November.† Hence Nicasio specimens may be fairly taken as representing the type locality, and November examples as the phase of pelage of the original specimen. As shown by Gray's "List of the Specimens of Mammals in the Collection of the British Museum" (p. 145), published the year following his description of *Tamias hindsii*, it would seem that of the west coast forms of *Tamias* he had at that time only the single type specimen of *T. hindsii*, which is entered as follows: "*a*. Cal-

* Mam. N. Am., p. 302.

† See Surgeon Hinds's "Summary of the Voyage" of the Sulphur, in "Zoology of the Voyage of the Sulphur," Vol. I, p. 3.

ifornia.—Presented by Capt. Sir E. Belcher, R. N." Unfortunately his description of *T. hindsii* is vague and unsatisfactory, and his figure of it, in the Voyage of the Sulphur, obviously worthless. The description, however, so far as it is distinctive, better fits *hindsii* than *townsendii*. Thus, "Rufous brown, with three rather close black streaks on the middle of back, the outer ones edged with a white streak, having an indistinct black edge to it on its outer side," is not at all applicable to *townsendii*, but agrees perfectly with *hindsii*.

In 1867,* however, Gray thoroughly confused the two forms, he including both under *T. hindsii*, and giving "California" as the habitat of his *townsendii*, which is in reality the exclusive home of *hindsii*.

*T. hindsii* differs from *T. townsendii* in the strongly reddish instead of olivaceous brown of the dorsal surface; the larger, more conspicuous post-auricular patches; the stronger contrast between the light dorsal streaks (the outer in *hindsii* being distinctly whitish) and the general ground color; the much more frequent obsolescence of the outer dorsal stripes; the much redder color of the basal portion of the hairs of the upper surface of the tail, and of the central area of the lower surface; the strong admixture of gray in the winter pelage (which is absent in *townsendii*); in the belly being usually washed with yellowish or pale rufous instead of clear white; the very strong contrast in color of the anterior and posterior portions of the dorsal area in late summer and early autumn; and in the very great seasonal changes in color as compared with the slight seasonal changes in *townsendii*.

## Tamias macrorhabdotes.

(Long-eared Chipmunk.)

*Tamias macrorhabdotes* Merriam, Proc. Biol. Soc. Washington, III, 1884–86, p. 26 (author's extras issued Jan. 27, 1886).

*Hab.*—Sierra Nevada Mountains, Placer County, Central California.

*Breeding Pelage.*—General color above, from nape to hips, including sides of body, pale cinnamon rufous, paler on flanks and shoulders; lower back, rump, and thighs dark gray. Dark dorsal streaks five, the outer pair short and more or less indistinct, the three median ones seal brown mixed and edged with pale

* Ann. and Mag. Nat. Hist., 3d ser., Vol. XX, 1867, p. 435.

chestnut, the middle one darkest. Inner pair of light stripes narrow, gray, more or less tinged with pale rusty; outer pair broader, nearly pure white. Facial stripes strongly contrasted; superciliary stripe narrow, white, bordered above by a narrow band of dusky chestnut; ocular stripe narrow, seal brown, edged with rufous; subocular stripe broad, white, confluent with the very large pure white post-auricular patch; malar stripe broad, dark chestnut, varied with rusty, passing into seal brown posteriorly, and extending beneath the ear to the white post-auricular patch. Ears very high and pointed, blackish externally, edged with rusty on the front border, and very broadly margined with white on the posterior edge; tip clothed internally with short rusty hairs. Tail above blackish, fringed with silvery, the hairs black at base, sub-basally ringed broadly with pale cinnamon or tawny, then with black, and tipped with white; below central area bright cinnamon rufous, varying to orange rufous, bordered broadly by black, with a conspicuous outer fringe of white. Feet grayish buff; ventral surface of body white.

*Post-breeding Pelage.*—Whole sides of body, from sides of neck to hips, very light cinnamon rufous, varying to very dark cinnamon rufous, the same tint also suffusing the dark dorsal streaks throughout their extent, this color prevailing over the dusky, in some specimens almost to the exclusion of the latter; buttocks and thighs fuscous brown, with a slight intermixture of gray; median pair of light streaks narrow, whitish, tinged with pale fulvous; outer pair of light streaks white, often with a faint yellowish tinge; ears, both internally and externally, and the dark facial stripes, strongly tinged with rusty, much more so than in the breeding pelage.

*Young.*—Similar to adults in post-breeding pelage, but the tints are all much duller, and the pelage is thinner, softer, and more woolly.

*Measurements.*—Total length (average of collector's measurements of 25 adult specimens in the flesh), 260 mm.; head and body, 134 mm.; tail vertebræ, 97 mm.; tail to end of hairs, 126 mm.; hind foot, 34 mm.; height of ear, 16 mm. (last two taken from skins).

*Specimens examined*, 40; collected as follows: Blue Cañon, Placer Co., Cal., May 25–June 4, 1886, C. A. Allen (Am. Mus., 3; Coll. C. H. Merriam, 2 =), 5; same locality and collector, Oct. 6–19, 1885 (Coll. C. H. M.), 10; same locality and collector, Oct. 3–15, 1886 (Am. Mus.), 24; Carson City, Nev., June 11, 1887, H. G. Parker (Cal. Acad. Sci.), 1.

The October series presents quite a range of color variation, mostly, however, seasonal, some of the specimens being practically indistinguishable from those killed in May, while others are still in the phase of late summer and early autumn. While the seasonal variation is less marked than in *T. hindsii* it is similar in character, and the change in autumn from the post-breeding to the winter and early spring phase progresses in the same manner,

giving rise in early fall specimens to a well-marked contrast between the anterior and posterior dorsal regions, the rufous suffusion of the anterior half resulting in a similar mantle-like effect.

The breeding season is evidently protracted over a long period, there being in the collection specimens less than half grown taken respectively June 11 and Oct. 8.

Mr. C. A. Allen, of Nicasio, Cal., who has collected nearly all of the specimens of this species known to be extant, kindly writes me that he has found the Long-eared Chipmunk at Blue Cañon, at an altitude of about 4700 feet, and also at Cisco, thirteen miles further east on the line of the Central Pacific Railroad. He speaks of it as a shy animal, hard to capture, living in dense brush, and taking shelter in a hole in the ground when disturbed, instead of resorting to a tree, as do some of its allies. He says further that during thirteen years collecting at Blue Cañon he has found there no other form of *Tamias*.

The single specimen from Carson City renders it probable that this species may yet be found at various intermediate points between Blue Cañon and Carson City.

## Tamias quadrimaculatus.

(Sacramento Chipmunk.)

*Tamias quadrimaculatus* Gray, Ann. and Mag. Nat. Hist., 3d ser., XX, 1867, p. 435.

*Tamias asiaticus quadrivittatus* Townsend, Proc. U. S. Nat. Mus., X, 1887, p. 171.

*Hab.*—Valley of the Sacramento River, California, north to Shasta Co., Cal., and Fort Klamath, Oregon.

*Post-breeding Pelage.*—Entire sides of the body strong ferruginous, the same tint also suffusing the dark dorsal stripes; head above, nape, and rump gray. Ventral surface intense white, sometimes faintly tinged with fulvous. Dark dorsal stripes five, the outer pair indistinct, forming a dark brown edging to the rufous of the flanks; middle stripe black, the next on either side centrally black edged with rufous. Median light stripes gray, outer pair white, sometimes tinged with a fulvous wash. Dark facial streaks narrow, rusty brown, the upper and middle one much darker than the lower one; light streaks fulvous white, varying to grayish white. Ears blackish externally, faintly edged with rusty on the front edge and broadly bordered with white posteriorly. Post-auricular patches of medium size, white. Tail above blackish, fringed with white, the hairs at the extreme base narrowly ringed with black, then broadly with pale rusty orange,

and then very broadly with black, and narrowly tipped with white; below, central area orange rufous, bordered broadly with a band of black, and a narrow external fringe of white. Feet orange buff.

*Fall Pelage* (October).—Similar to the post-breeding phase, except that the rufous suffusion of the flanks is darker, and the gray of the rump occupies the posterior half of the dorsal region, the anterior half being strong rufous, forming a scapular mantle. Ears much more reddish in front, and the dark facial streaks darker, the malar streak terminating in a dusky patch beneath the ear.

*Young.*—A single one-third-grown young example (Fort Klamath, August) is like the August adults in coloration, but in other respects presents the usual characters of juvenility.

*Measurements* (based on skins).—Length, 249 mm.; head and body, 134 mm.; tail to end of vertebræ, 93 mm.; tail to end of hairs, 115 mm.; hind foot, 30 mm.; height of ear, 14 mm.

*Specimens examined*, 9, as follows: Nevada City, Cal., Oct., 1872, E. W. Nelson (Coll. C. H. Merriam), 1; Fort Crook, Cal., Sept. 27, 1860, D. F. Parkinson (Nat. Mus.), 2; Baird, Shasta Co., Cal., June 17, 1883, C. H. Townsend (Nat. Mus.), 1; Mt. Shasta, Siskiyou Co., Cal., July 14, C. H. Townsend (Nat. Mus.), 3; Fort Klamath, Oregon, Aug., 1883, Capt. C. E. Bendire (Coll. C. H. Merriam), 2.

The nine specimens (mostly in very poor condition) referred to this form are all in summer pelage, except one taken in October. The latter is in the "mantled" stage common to *T. hindsii* and *T. macrorhabdotes* at the same season, and is of a darker shade of rufous than the July and August specimens.

This species differs from *T. macrorhabdotes* in its smaller ears, much smaller post-auricular patches, blacker dark dorsal streaks, and clear ferruginous tint of the flanks. It is thus in general features, as in habitat, intermediate between *T. hindsii* and *T. macrorhabdotes*.

The Nevada City specimen agrees so evidently with Gray's description of his *T. quadrimaculatus*, and so nearly with it in locality, that I have adopted Gray's name for this form, although at first inclined to identify Gray's species with *T. macrorhabdotes*. The two are closely related, but one is apparently a valley form, the other a mountain form, their habitats thus entailing very different physiographic conditions—a difference one familiar with the very diverse topographic and climatic conditions of the two regions can well appreciate. Gray's specimen came from Michi-

gan Bluff, in the Sacramento Valley, and was collected by F. Gruber, Nov. 1, 1862. His description in full (l. c.) is as follows:

" *Tamias quadrimaculatus.*

*T. Townsendi*, GRUBER.

Fur dark grizzled; shoulders and sides reddish; the pale dorsal streaks broad, indistinctly marked, grizzled; outer one narrow and more marked; the dark streaks broad, short, the outer ones scarcely defined; neck with a large white spot on each side of the nape, behind the ear, and with a large black spot beneath it at the end of the very distinct dark under face-streak; tail black, white-washed, beneath orange, blackish-edged. Young like adult, but dark streaks more marked. Same size as *T. Hindsii.*

" *Hab.* California, Michigan Bluff (Gruber). B. M."

Gray's type of his *T. quadrimaculatus* is still fortunately extant, and I am greatly indebted to Mr. Oldfield Thomas, Curator of Mammals in the Natural History Department of the British Museum, for kindly comparing with it a specimen of *T. macrorhabdotes*, sent over to him for the purpose. He says: " The *type* of *T. quadrimaculatus* is unquestionably the same as the *T. macrorhabdotes* you send over. I had not recognized it as distinct, partly on account of the shrunk state of the original skin. The date of the type is 1/11/62, and its locality Michigan Bluff, Cal." He further writes on the back of the label of the specimen of *T. macrorhabdotes* sent to him: " Certainly identical with the type of *T. quadrimaculatus*, Gr., which only differs by more yellowish and less sharply defined underside, and more fulvous flanks and shoulders." As these are part of the differences distinguishing the two forms, it seems quite proper to retain Gray's name for the Sacramento Valley form.

Mr. Townsend's specimens from Siskiyou and Shasta Counties seem, as well as can be judged (they are in poor condition, and part of them made up from alcoholic specimens), all referable to this form, which Mr. Townsend found to be quite abundant in Siskiyou County, and in the northern part of Shasta County, on the western side of the Sierras.*

* As shown by the labels, part of these specimens are erroneously entered, in Mr. Townsend's paper (l. c.), as from Lassen County. The specimens thus entered evidently belong to two lots, collected at different times and places, the June series alone belonging to the form mentioned as "abundant on the eastern slope of the Sierras in Lassen County," and referable to the *T. amœnus* of this paper.

## **Tamias senex,** sp. nov.

*Hab.*—Sierra Nevada Mountains, Placer Co., California, north to Fort Klamath, Oregon.

*Breeding Pelage.*—Above general color gray, darker on head, lower back, and thighs, lighter on nape, and washed with yellowish on sides of neck and shoulders. Flanks rather strongly washed with yellowish brown. Median dark dorsal stripe brownish black, edged and mixed with rusty brown ; the next dark stripe on either side rusty, mixed with blackish ; outer dark stripes dull dark rusty brown, darker than the sides below. Median pair of light stripes narrow, light gray ; outer pair rather broader, but of nearly the same tint—clear light gray. Ventral surface dull soiled white. Light facial stripes grayish white ; dark ones rusty brown, somewhat mixed with blackish. Ears externally blackish, posterior border broadly edged with whitish, confluent with the rather small grayish white post-auricular patches. Tail above blackish, the hairs yellowish ochraceous at the base, subterminally broadly ringed with black and tipped with white ; below, central area pale orange, edged with a band of black, the hairs tipped broadly with white.

*Measurements.*—Total length (from collector's measurements), 263 mm.; head and body, 149 mm.; tail to end of hairs, 114 mm.; hind foot, 35 mm.; height of ear, 14 mm. (last two from the skins).

Type, No. 1133 (Coll. C. H. Merriam), Summit of Donner Pass, Placer Co., Cal., July 1, 1885, L. Belding.

*Specimens examined*, 7 ; collected as follows : Summit of Donner Pass, Placer Co., Cal., July 1, 1885, L. Belding (Coll. C. H. Merriam), 1 ; Donner, Placer Co., June 25, 1886, C. A. Allen (Coll. C. H. Merriam), 3 ; Glenbrook, Douglas Co., Nev., May 29, 1889, C. A. Keeler (Dept. of Agric.), 2 ; Fort Klamath, Oregon, May 19, 1887, Dr. J. C. Merrill (Nat. Mus.), 1.

The seven specimens referred to this form are all adults taken in May and June, and hence represent the pelage of the breeding season. Probably in the late summer phase they are more suffused with fulvous, especially on the flanks.

This is apparently a large pale form of the *T. hindsii* stock, and hence allied to both *T. macrorhabdotes* and *T. quadrimaculatus*, which separate it widely, geographically and otherwise, from *T. hindsii* of the coast region. It differs from *T. macrorhabdotes*, its geographically near neighbor, in having smaller ears, very much smaller and gray, instead of white, post-auricular patches, and in having only a faint suffusion of pale yellowish brown above (in the breeding phase of pelage) instead of a strong suffusion of dark cinnamon or pale chestnut brown. It is probably an alpine

form, occurring with the much smaller *T. frater* of the Sierras in Placer County, and eastward to the eastern border of Lake Tahoe in Nevada. It also ranges northward to the region about Fort Klamath, whence there is a specimen in the material in hand, and also two of *T. quadrimaculatus*, and several examples of the small *T. amœnus*.

Mr. C. A. Allen kindly writes me that the three specimens he obtained at Donner were taken at an altitude of about 7000 feet. He recognized this form as differing greatly in habits, as well as size, from the ordinary Donner Chipmunks ( *T. frater*), as will be noticed later under that species. He speaks of it as very scarce, and says he thought the few individuals he saw might be stragglers of the long-eared form ( *T. macrorhabdotes*) occurring lower down the mountain at Blue Cañon, which it resembles in habits.

## Tamias merriami.

(Merriam's Chipmunk.)

*Tamias asiaticus merriami* Allen, Bull. Am. Mus. Nat. Hist., II, No. 3, p. 176 (Oct. 21, 1889).

*Hab.*—Mountains of Southern California, from San Diego County north to Tulare and Monterey Counties.

*Breeding Pelage.*—General color above cinereous gray, tinged faintly with yellowish by the admixture of pale rusty-colored hairs. All of the dorsal streaks dull, not sharply contrasted. Dark streaks dusky brown, mixed with pale yellowish rufous, the outer pair dull yellowish brown, slightly mixed with dusky. Inner pair of light streaks pale gray, mixed with pale yellowish ; outer pair light silvery gray. Light facial streaks broad, gray, the dark ones narrow, rusty brown. Sides of body slightly suffused with pale yellowish brown. Post-auricular patches small, indistinct, grayish, but little paler than the surrounding fur. Ventral surface whitish gray. Tail above blackish, fringed with gray, the hairs apically and basally black, with a broad intermediate zone of pale yellowish white ; below, central area deep reddish chestnut, paler at the edges, and bordered with a broad band of black, the latter fringed with whitish.

*Post-breeding Pelage.*—Flanks golden rufous ; dark dorsal streaks yellowish rufous, the median one centred posteriorly with black ; light dorsal stripes silvery gray, the outer pair broader and whiter ; light facial bands ashy gray, the dark ones dull rusty brown. Central area of tail below orange chestnut ; sub-basal zone of the hairs of the upper surface orange yellow.

*Young.*—In general effect the coloration resembles that of the adults in May, but the flanks are more rufous, and the dorsal streaks better defined and stronger,

the outer light streaks being nearly pure white. The pelage, however, is very fine and soft, strongly in contrast with the rather coarse, heavy pelage of the adults.

*Measurements.*—Size very large, tail very long, ears high and pointed. Total length (average of 10 specimens measured in the flesh by the collector), 285 mm.; head and body, 140 mm.; tail vertebræ, 117 mm.; tail to end of hairs, 146 mm. (longer than head and body); hind foot, 34 mm.; height of ear, 12–14 mm. (measurements of hind foot and ear taken from skins).

*Specimens examined*, 30; collected as follows: San Bernardino Mountains (altitude 7000 feet), San Bernardino Co., June 10–13, 1887, F. Stephens (Coll. Am. Mus., 8; other collections, 2 = ), 10; Cuyamaca Mountains, San Diego Co., June 6–8, 1889, F. Stephens (Coll. F. Stephens), 2; Ballena, San Diego Co., March 7 and June 4, 1889, F. Stephens (Coll. F. Stephens), 2; Smith Mountain, San Diego Co., June 27–29 and July 5, 1889, F. Stephens (Coll. F. Stephens and C. H. Merriam), 4; Volcan, San Diego Co., Aug. 26, 1884, F. E. Blaisdell (Nat. Mus.), 1; Wilson's Peak, San Gabriel Mountains, Los Angeles Co., May 8 and June 25, 1889, E. C. Thurber (Coll. M. M. Green), 4; Fort Tejon, Tulare Co., John Xantus (Nat. Mus.), 1; near Mt. Whitney, Tulare Co., Sept. 10, 1875, H. W. Henshaw (Nat. Mus.), 1; Bixby Creek, Monterey Co., July 4–6, 1889, Walter E. Bryant (Coll. Cal. Acad.), 3.

The specimens from the San Gabriel Mountains, especially the young examples, are rather more highly colored than those from the San Bernardino Mountains. The Fort Tejon specimen, collected many years since (without date and in poor condition) is similar to the San Gabriel and Volcan specimens, though rather more suffused with yellow. The specimen from "near Mt. Whitney" * is in autumn dress, presenting the golden rufous on the sides and in the dorsal streaks characterizing the post-breeding pelage. It closely resembles the August specimen from Volcan. One of the specimens from Bixby Creek, Monterey Co., collected July 4, is similar, having nearly completed the moult from the breeding pelage. Another specimen from the same locality, taken July 6, which has also moulted, is darker, with flanks browner, and the dark dorsal streaks less mixed with golden.

Specimens in breeding dress also vary in the amount of yellowish suffusion, some showing very little, even on the flanks, and none in the back, while in others it is quite pronounced.

The habitat of this strongly-marked species appears to be the mountain ranges generally of Southern California, from about 5000 feet upward.

* Other specimens, labeled as from near Mt. Whitney, are referable to *T. speciosus*.

## **Tamias speciosus** *Merriam*, MS.

(San Bernardino Chipmunk.)

*Hab.*—San Bernardino Mountains, Southern California.

*Post-breeding Pelage.*—" Stripes all bright and distinct. Outer light stripe on each side *pure white;* inner light stripe on each side grizzled gray ; dark stripes dark brown, strongly suffused with ferruginous ; sides ferruginous, continuous with external lateral stripe, which is thus not defined below. Post-auricular patches white, about as large as the ears, and nearly meeting posteriorly. Face stripes bright and distinct from nose to ear ; supra- and infra-orbital stripes pure white ; superior and inferior dark stripes dusky, obscured with rusty ; eye-stripe black with rusty suffusion at end of nose and base of ear, the latter continuous with a rusty patch on anterior convexity of ear. Tail about as long as body, without the head, moderately bushy, deep bright chestnut on both sides, obscured above by black hairs, and edged with yellowish ; below, with terminal fourth or fifth and a lateral subterminal border black edged with yellowish. Ear tricolor; rusty at base anteriorly ; anterior three-fourths black ; posterior fourth grayish.

" Size medium or rather small. Head and body, 120 mm. ; tail vertebræ, 79 mm. (measured in the flesh). Hind foot, 32 mm. (taken from the dry skin).

" Type, No. $\frac{1148}{1804}$, ♂ ad., Merriam Collection, San Bernardino Mts., Cal., June 22, 1885, collected by F. Stephens." (*Merriam*, MS.)

*Breeding Pelage.*—Above dull, faded, yellowish gray, with two broad stripes of clear white. The dark stripes are only a little darker than the general surface, having lost nearly all of the bright ferruginous of the fresh autumn coat, which color has also nearly all disappeared from the flanks, which are only faintly suffused with pale yellowish brown, the outer dark stripe alone showing a little pale ferruginous.

*Young.*—Similar to the adults in breeding pelage, but colors rather brighter and markings stronger.

*Measurements.*—Total length, 234 mm.; head and body, 123 mm.; tail vertebræ, 91 mm.; tail to end of hairs, 111 mm.; hind foot, 32 mm.; height of ear, 12 mm. (Average of 9 adults measured by collector before skinning.)

*Specimens examined*, 24, as follows : San Bernardino Mountains, Los Angeles Co., California, June 9–22, 1885, 1886, 1887, F. Stephens (Coll. C. H. Merriam, 1 ; Am. Mus., 4 ; Nat. Mus., 6 ; Coll. F. Stephens, 6=) 17 ; same locality and collector, Aug. 17, 1885 (Coll. C. H. M.), 1 ; Alpine City, Bear Valley (San Bernardino Mts.), Cal., A. Forrer (Coll. C. H. M.), 1 ; San Bernardino Mts., June 12, 1889 (Cal. Acad. Sci.), 1; Cañon las Uvas, Cal., J. Xantus (Nat. Mus.), 1 ; "near Mt. Whitney," Tulare Co., Cal., Sept. 6–10, 1875, H. W. Henshaw (Nat. Mus.), 3.

Of the 17 San Bernardino specimens before me taken in June, only one (Dr. Merriam's type, described above) is in the post-breeding dress. In this specimen the pelage is very short, and

there are slight traces of the faded breeding pelage still remaining. Five of the remaining 16 specimens are young-of-the-year, nearly full grown.

Of the other 11, all except the one above described (No. 15,967, U. S. Nat. Mus.), show more or less traces of the new coat, either in the form of irregular patches on the sides and back, or as new hairs intermixed more or less generally with the old. The specimens from the vicinity of Mount Whitney and Cañon las Uvas, taken in September, differ from the more advanced (in respect to moult) June specimens from the San Bernardino Mountains only in having the sides washed a little heavier with rufous.

In coloration, particularly in the faded breeding pelage, this species somewhat resembles *T. merriami*, but the latter is nearly one-fourth larger, and has a disproportionately longer tail. The character of the pelage in the two species, however, is very different, and the resemblance in coloration is only in general effect, differing in detail at nearly every point. It more closely resembles *T. frater* from Donner, Placer County, from which, however, it is readily separable by various characters, as noticed under that species.

The striking features of *T. speciosus* are the very unusual extent of black at the tip of the tail, both above and below, and the great breadth of the pure white outer pair of light dorsal streaks.

In the San Bernardino Mountains this species occurs with *T. merriami*. Mr. F. Stephens, who has collected nearly all of the specimens of both these forms thus far obtained, writes me that they occur together at altitudes of from five thousand to nine thousand feet, but that above nine thousand feet he met with only *T. speciosus*. At Ballena, and on Smith and Cuyamaca Mountains he found only *T. merriami*. *T. speciosus*, however, occurs, as shown by specimens obtained by Mr. Henshaw, "near Mount Whitney"; Xantus also collected it at Cañon las Uvas, Kern County, and it doubtless occurs at suitable localities between these points and the San Bernardino Mountains.

## **Tamias frater,** sp. nov.

(Sierra Nevada Chipmunk.)

*Tamias quadrivittatus* Henshaw, Ann. Rep. Wheeler's Geogr. Sur. West of 100th Meridian, 1876, p. 311 (in part—except spec. No. 721).

*Hab.*—Sierra Nevada Mountains, Placer County, California.

*Breeding Pelage.*—General color above pale gray, darker, more leaden gray on lower back and thighs, lighter, more whitish gray on nape, side of shoulders, and interscapular region. Sides more or less faded rusty brown; ventral surface whitish gray. The three median dark stripes more or less blackish, edged and mixed with chestnut; the outer stripe on each side lighter rufous, rarely with any mixture of dusky, distinct only on the upper border, the lower blending with the rufous of the flanks. Median pair of light stripes, narrow, ashy; outer pair very broad, and clear white. Light facial stripes white or grayish white; dark ones rusty brown, mixed with dusky; the eye-stripe is black in front of the eye, and forms a blackish spot immediately behind the eye, passing posteriorly into bright rusty brown. Outer surface of ears black, with a rusty spot in front at the base, and the posterior border broadly grayish white. Post-auricular spot quite large, nearly pure white (in some specimens grayish white) and conspicuous. Tail, above, rusty orange varied with black, the hairs being orange at base, subterminally broadly ringed with black, and tipped with buff; below, central area orange, bordered narrowly and tipped broadly with black, the tips of the hairs forming an outer fringe of pale yellow or yellowish white.

*Post-breeding Pelage.*—Dorsal region generally more suffused with rufous, with a much heavier wash of bright rufous on the sides.

*Measurements.*—Length (average of collector's measurements of 20 specimens in the flesh), 223 mm.; head and body, 119 mm.; tail to end of hairs, 97.5 mm.; hind foot, 32 mm.; height of ear, 11 mm. (last two from skins).

Type, No. 1308 (Coll. Am. Mus. Nat. Hist.), ♀ ad., Donner, Cal., June 7, 1886, C. A. Allen.

*Specimens examined*, 28; from the following sources: Donner, Cal., June 7–8, 1888, C. A. Allen (Am. Mus. Nat. Hist.), 4; same locality and collector, June 10–22, 1886 (Coll. C. H. Merriam), 15; same locality and collector, June 10, 1888 (U. S. Nat. Mus.), 2; Glenbrook, Nev., May 29, 1889, C. A. Keeler (Dept. of Aric.), 2; Lake Tahoe, Nev., H. W. Henshaw, Oct., 1876 (Nat. Mus.), 1.

The two Glenbrook specimens are quite small, but are better referred here than elsewhere.

This species finds its nearest ally in *T. speciosus*, from which it differs in the worn breeding pelage, in stronger colors, having more black in the dark dorsal stripes, and the flanks more heavily washed with a brighter rufous. The tail is much less black above,

the central area below much paler, and the black tip much shorter. It is also appreciably smaller, with a disproportionately shorter and more bushy tail.

It also closely resembles, in general coloration, when in the faded breeding pelage, *T. amœnus*, from which, however, it notably differs in much larger size, in the large white (instead of small gray) post-auricular patches, and in the color of the tail, both above and below, but especially above, the basal portion of the hairs being deep orange, varying to rufous orange, this color much *stronger* than that of the central area of the tail below, while in *amœnus* the base of the tail hairs above is buff (often very pale buff), much *paler* than the central area of the tail below.

The large series from Donner (about 40 specimens, all taken in the month of June), proves most unexpectedly to contain representatives of three apparently very distinct species, four of the specimens being referable to the large gray *senex*, 21 to the present species, and 16 to *amœnus*, to which latter are also referable specimens from neighboring localities, as Bronco, Nevada Co., Cal., and Glenbrook, Douglas Co., Nev. Both *senex* and *amœnus* occur also together at Fort Klamath, and doubtless at intermediate points. The *amœnus* series from Donner I at first regarded as young of the year of *frater*, although the character of the pelage seemed to indicate maturity, it having the same worn faded appearance as that of the *frater* series. On closer examination traces were seen in some specimens of a change of pelage, and also females that had evidently nursed young.

The Lake Tahoe specimen seem satisfactorily referable to *frater*, allowing for difference of season, and the usual brighter tints of the autumnal phase of coloration, traces of which is shown in some of the June specimens from Donner.

Mr. C. A. Allen, the collector of the Donner series, kindly writes me, in answer to inquiries, as follows respecting the habits of this species as compared with those of *T. macrorhabdotes*. "These smaller Chip Squirrels, as I called them at the time, are somewhat different in their habits from the Long-eared Chip; they are not shy like the latter, and are very fond of running over fallen logs and up living standing trees, and when they are alarmed will run right by, or through, or over a ledge of rocks or stones,

and take shelter by running up the first tree; or if in a tree will go up higher instead of coming down to hunt for a hole, more like the Red Squirrel of the East. This is the most striking feature I noticed about them. I have seen as many as three run up one tree at once, when they could much easier have taken shelter among rocks or stones. I also noticed they inhabit the standing live trees from choice more than any other Chip Squirrel I have ever met. The Long-eared Chip is much more shy. I have not seen it climb a tree more than two or three times in all my collecting, for a period of thirteen years, about Blue Cañon. I have seen them on a dead stump eight or ten feet high, but they always run down and scramble for a hole in the ground when alarmed."

## **Tamias amœnus,** sp. nov.

(Klamath Chipmunk.)

*Hab.*—Fort Klamath, Oregon, and southward to Placer County, California.

*Spring Pelage* (April).—General color above vinaceous gray, including head, neck, sides of shoulders, rump, and thighs. A small area on the flanks bright ochraceous brown. Ventral surface white, in some specimens tinged with yellow. Dark dorsal streaks five, the three median ones dark seal brown, varied at the edges and anteriorly with rufous; outer pair chestnut, varying to dusky and to chestnut rufous in different specimens. Median light stripes light gray, with a vinaceous tinge; outer clear white. Tail above black varied with ochraceous, the hairs being black at the extreme base, then ringed narrowly with pale ochraceous, then more broadly with black, and tipped with ochraceous; below central area pale orange yellow, edged and broadly tipped with black, and with the tips of the hairs ochraceous yellow. Ears rather large, blackish externally, with a slight tinge of pale rust at the base anteriorly, and broadly edged posteriorly with grayish white, confluent with the rather large whitish post-auricular patches. (Fort Klamath specimens.)

*Breeding Pelage* (June).—Pelage shorter, more worn, and coloration much paler. The vinaceous cast in the gray of the upper parts has disappeared; the median light stripes are paler and more of a yellowish cast; the rufous of the flanks has become much paler, and the ochraceous at the base of the tail hairs above has faded to pale buff. (Donner specimens.)

*Post-breeding Pelage* (October).—Almost indistinguishable from the early spring pelage. (Bronco specimens.)

*Measurements.*—Size, small; length, 207 mm.; head and body, 116 mm.; tail vertebræ, 70 mm.; tail to end of hairs, 91 mm.; hind foot, 30 mm.; height of ear, 11 mm. (Average of 14 specimens, measured before skinning by the collector.)

Type, No. 3469 (Coll. C. H. Merriam), ♀ ad., May 16, 1887, Dr. J. H. Merrill, Fort Klamath, Oregon.

*Specimens examined*, 38; collected as follows: Fort Klamath, Oregon, April 27–May 16, 1887, Dr. J. C. Merrill (Col. C. H. Merriam and Nat. Mus.), 8; Fort Klamath, Oregon, April 18, 1888, S. Parker (Coll. C. H. M.), 1; Lassen Co., California, July, 1884, C. H. Townsend (Nat. Mus.), 2 (skinned from alcohol and discolored); Lassen Co., California, June, 1884, C. H. Townsend (Nat. Mus.), 6 (in bad condition, somewhat discolored from immersion in alcohol); Donner, Placer Co., California, June 11–24, 1886, C. A. Allen (Coll. C. H. M.), 15; same locality and collector, June 7, 1888 (Nat. Mus.), 1; Bronco, Nevada Co., California, Oct. 12, 1888, C. A. Allen (Coll. C. H. M.), 2; Glenbrook, Douglas Co., Nevada, May 28–June 2, 1889, C. A. Keeler (Dept. of Agric.), 3; Carson City, Nevada, June 28, 1887, H. G. Parker (Coll. Cal. Acad. Sci.), 1.

A few of the Donner specimens, although taken in June, are in practically the same condition of pelage and coloration as the Fort Klamath April and May specimens (April 18, May 16); but most of the Donner specimens are more or less bleached and worn; only one (a male), however, shows indications of the new coat, merely a few tufts here and there of new hair. The numerous adult females in the series appear not to have nursed young the season of their capture, having been killed apparently just prior to the breeding season. On the labels of one of the Fort Klamath specimens, taken May 15, is written by the collector, "contained five fœtuses." Two of the Glenbrook specimens are much shrunken, apparently by some antiseptic used in their preservation; the other is strikingly similar to Fort Klamath and some of the Donner specimens. The Bronco specimens, in autumn pelage, are indistinguishable from spring Klamath specimens, showing that the coloration and character of the pelage is practically the same in October and April, as is usually the case in this group.

The Lassen County specimens are more or less ragged and distorted, besides having undergone more or less change of color by immersion in alcohol, or some other antiseptic solution. I have, however, little hesitation in referring them to this form.

*Tamias amœnus* finds its nearest ally in *T. frater* of Placer and neighboring counties, California, and adjoining portions of Nevada, from which it differs in being fully one-third smaller,

and in the coloration of the tail, and somewhat in general coloration; although in the latter respect there is little difference when faded June specimens of each are compared. In *amœnus* the pale zone on the basal portion of the hairs of the upper surface of the tail is pale light buff or yellowish white, much paler than the rusty yellow orange central area of the lower surface. In *frater* the sub-basal zone of the hairs of the upper surface of the tail is deep rusty orange, generally of a much deeper tint than the central area of the lower surface of the tail. The central dark stripes on the back in *amœnus* are nearly deep black, instead of dark chestnut, and the light stripes are strong, pure vinaceous gray, instead of yellowish gray, as in *frater*.

*T. amœnus* is also closely allied to *T. pictus* of the adjoining desert region to the eastward, with which, along the borders of this region, it may intergrade.

The habitat of *T. amœnus* would seem to include the Sierra Nevada (at least the eastern slope) from about Lake Tahoe northward to Lassen and Shasta Counties, California, and also thence northward to Fort Klamath. The region between Placer and Shasta Counties is at present, however, so far as *Tamias* is concerned, a *terra incognita*.

## Tamias bulleri.

(Mexican Chipmunk.)

*Tamias asiaticus bulleri* Allen, Bull. Am. Mus. Nat. Hist., II, No. 3, p. 173 (Oct. 21, 1889).

? *Tamias asiaticus*, var. *quadrivittatus* Thomas, Proc. Zool. Soc., 1882, p. 372.

? *Tamias asiaticus*, subsp. *quadrivittatus* Sclater, Biol. Centr. Am., I, p. iii (footnote), Dec., 1882.

*Hab.*—Sierra del Valparaiso, State of Zacatecas, Mexico. (Durango, Central Mexico?)

*Post-breeding Pelage* (July 27–Aug. 2).—General color above gray, very faintly tinged with buff. Sides slightly more buffy; ventral surface white, hairs plumbeous at base. Three median dark dorsal stripes blackish (dark seal brown) edged, and sometimes more or less mixed with yellowish chestnut; outer dark stripes yellowish chestnut, sometimes slightly mixed with blackish hairs, short and not sharply defined below. Median light stripes narrow, gray; outer ones broader, white or grayish white. Light facial stripes very broad, clear white; upper dark stripe blackish, edged with rusty; eye-stripe narrow in front of the eye, very broad behind the eye, black, bordered posteriorly with

rusty; malar stripe broad, rust-brown, centred with dusky, and extending beyond the base of the ear. Ears of medium size, broad and rounded; externally tricolor, bordered broadly in front with pale rust, and apically and posteriorly with a broad margin of white, leaving a blackish basal central area, the white posterior border confluent with the large, conspicuous white post-auricular patch. Ears internally black at base, the posterior and apical two-thirds rusty. Tail narrow, thinly haired; above black varied with light buff and whitish, the hairs being narrowly ringed with light buff at the base and tipped with soiled white; below central area ochraceous, varying from pale to deep ochraceous, narrowly bordered with black and fringed with whitish.

*Young.*—Young of the year, nearly full grown, differ from the adults in being more heavily washed on the flanks with rusty brown, and with the dorsal stripes, particularly the middle pair of light stripes, faintly suffused with rusty.

*Measurements* (approximate, from skins).—Length, 250 mm.; head and body, 127 mm.; tail vertebræ, 98 mm.; tail to end of hairs, 125 mm.; hind foot, 33.5 mm.; height of ear, 12 mm.

*Specimens examined*, 12 (Am. Mus. Nat. Hist., 8; Coll. C. H. Merriam, 4); all collected by Dr. Audley Buller, in the Sierra del Valparaiso (altitude 8000 feet), Zacatecas, Mexico, July 27–Aug. 2, 1889.

This species somewhat resembles *T. cinereicollis* in size and general proportions, in the character and color of the dorsal stripes, and in the general effect of the coloration; but differs from it in its shorter and less pointed ears, in the sides being pale buff brown (amounting in most specimens to merely a faint wash at the end of the hairs) instead of strong yellowish brown, in the central area of the tail being ochraceous instead of orange rufous, and especially in the stronger contrast between the light and dark facial streaks, the superciliary one being much broader and whiter, and all the dark ones much broader and darker, with the eye stripe twice as broad, and *black* instead of pale rusty brown.

Mr. Oldfield Thomas has recorded (l. c.) specimens of *Tamias* from Cuidad, Durango (two specimens, July 6, 1881, A. Forrer), obtained at an altitude of 8100 feet in the Sierra Madre, which may prove to be the same as *T. bulleri*, since they come from a similar altitude and from a not very distant point.*

* In my former notice of this species (l. c.), Mr. Thomas's record of a form of *Tamias* from Central Mexico was inadvertently overlooked.

## **Tamias cinereicollis,** sp. nov.

(Arizona Chipmunk.)

*Hab.*—San Francisco Mountain and neighboring Mogollon Mountains of Central Arizona.

*Autumn Pelage* (August and September).—General color above gray; sides between shoulders and hips yellowish brown; below grayish white; nape, sides of neck, and cheeks (below malar stripe), gray, this color extending back to posterior border of scapular region, but there more blackish, and sometimes with a faint tinge of brownish suffusion. Thighs and buttocks very faintly tinged with pale yellowish brown. Dark dorsal stripes broad, deep black, edged with deep chestnut brown, the outer one on each side narrower, shorter, and less black, but sharply defined and strongly marked. Inner pair of light dorsal stripes clear whitish gray; outer pair broader and clear white. Light facial stripes rather clear white; the dark ones very broad, dull rusty brown, the ocular stripe alone much mixed with black, generally distinctly black immediately before and behind the eye. Ears externally with the central area blackish, the anterior border rusty, and the posterior broadly edged with grayish white; inner surface pale rusty. Light patch behind the ear light gray, scarcely lighter than the surrounding pelage, and hence not conspicuous. Tail above blackish, the hairs ochraceous at base and tipped broadly with buff; below broad central area orange rufous, bounded by a very narrow line of black, fringed with buff.

*Breeding Pelage* (May–July).—Pelage softer and fuller (comparing especially May and August specimens); colors all dull and bleached, the tints of gray, black, and white, all less pure and clear, and the sides only faintly washed with pale yellowish brown, varying in different specimens to pale buff, sometimes not appreciably different from the pale dull yellowish gray of the general color of the dorsal surface.

*Young.*—Half-grown young are similar in color to adults in August and September, but the pelage is thinner and more silky, with the unmistakable look of juvenility.

*Measurements* (average of 14 specimens, measured by the collector before skinning).—Total length, 247 mm.; head and body, 121 mm.; tail vertebræ, 102 mm.; tail to end of hairs, 126 mm.; hind foot, 35 mm.; height of ear, 13 mm.

Type, No. 17,597, U. S. Dept. Agr., ♀ ad., San Francisco Mountain, Arizona, August 2, 1889, Merriam and Bailey.

*Specimens examined,* 46; from the following sources: San Francisco Mountain, Arizona, July 30–August 29, C. Hart Merriam and Vernon Bailey (Dept. of Agric.), 22; Mogollon and San Francisco Mountains, Arizona, May, June, and Oct., Dr. Edgar A. Mearns (Am. Mus. Nat. Hist.), 14; San Francisco Mountain, July 20–22, F. Stephens (Nat. Mus. and Am. Mus.), 4; Springerville, Arizona, September 11, E. W. Nelson (Nat. Mus.), 6.

The seasonal variation in the color and character of the pelage is so striking that May and August specimens might easily be looked upon as representing totally distinct species. Fortunately the large series before me represents nearly every stage of transition from the bleached phase of the breeding season to the freshly acquired autumn coat with its bright strongly contrasting tones and markings. The dates represented are May 25–27 (7 specimens); June 6, 11, 17 (4 specimens); July 20–22 (4 specimens); July 30–31 (3 specimens); August 1, 2, 5, 10, 12–15, 26–29 (18 specimens); September 11 (6 specimens); October 4–5 (2 specimens). This series shows that the date of moult varies widely in different specimens. Some of the May specimens show no trace of the new coat; in others there is a mixture of the new with the old, in the form of bright patches of new short hairs on the sides and a sprinkling of new hairs in the back. Two of the June specimens have not changed, while one is in the transition, patchy phase, and one has nearly completed the change to the new coat. A specimen taken July 20 is in *thin* bleached pelage, having lost much of the old coat without having acquired any distinct traces of the new coat; two others, taken two days later at the same locality, have in great part acquired the new coat. Those taken July 30 and 31, as well as all of the August specimens, are in autumn pelage. September and October specimens are not appreciably different from August ones, except that as the season advances the pelage becomes a little fuller and softer.

This form is most nearly related to *T. umbrinus* of the Wahsatch and Uintah Mountains further north, but differs from it in having the sides of the neck and shoulders rather clear gray, in contrast with the flanks instead of nearly the same color, and in having the outer dark dorsal streak blackish and distinctly defined instead of obsolete, as in the Wahsatch form. The dark facial stripes are also much broader, especially the lower one, and dark rusty brown instead of pale brown. The dark dorsal stripes are blacker, and the light ones whiter, the light and dark stripes being thus much more sharply contrasted.

It bears only a distant resemblance to *T. bulleri*, as already noticed.

According to Dr. Mearns (MS. notes), this mountain species "does not descend to the lower limit of the pine belt, and is most abundant in the fir and spruce forests, at an elevation of from 7000 to 11,000 feet, its range barely reaching that of *Tamias dorsalis*, which is mainly an animal of the plains."

The habitat of this form is the heavily wooded mountain region of Central Arizona, and is thus isolated from all the other forms of *Tamias*, except the desert forms (with which it has no close resemblance) by arid, forestless areas.

## **Tamias umbrinus,** sp. nov.

(Uintah Chipmunk.)

*Hab.*—Mountains of Northern and Central Utah (Wahsatch and Uintah Ranges).

*Autumn Pelage.*—General ground color above yellowish-brown gray. Sides dull yellowish brown; top of head and nape more grayish; rump and hind limbs externally dusky yellowish-gray brown; under parts grayish white. Median dark dorsal stripe black, mixed and edged with dull yellowish brown, especially posteriorly; the next dark stripe on either side blackish, much more mixed with dull rusty brown, in some specimens the brown prevailing over the black; outer dark stripes short and very narrow, nearly without black, and generally almost or quite obsolete. The two median light dorsal streaks light gray; the two outer broader and whiter. Facial streaks dull, the light ones gray, the dark ones dusky brown, the lower (malar) one very narrow, and dull brownish dusky. Ears externally black, conspicuously bordered with grayish white. Post-auricular patches of medium size, grayish white. Tail above mixed orange and black; below with an orange rufous central area, rather broadly bordered with black, and an external fringe of yellowish.

*Measurements.*—Size large; tail long, full, and bushy; ears medium. Length, 249 mm.; head and body, 125 mm.; tail vertebræ, 100 mm.; tail with hairs, 135 mm.; hind foot, 32 mm.; height of ear, 10 mm. (Average of 10 specimens, measured by collector before skinning.)

*Specimens examined*, 15; collected as follows: Uintah Mountains, thirty miles south of Fort Bridger, Wyo., Sept. 19–20, 1888, Vernon Bailey (Coll. C. H. Merriam), 7. Fort Bridger, July, 1872, E. W. Nelson (Coll. C. H. M.), 1; Ogden, Utah, Oct. 5, 1888, V. Bailey (Coll. C. H. M.), 3; Wahsatch Mountains, sixteen miles east of Salt Lake City, Utah, Oct. 31, 1888, V. Bailey (Coll. C. H. M.), 1; Uintah Mountains, Sept. 20, 1870, H. D. Schmidt (Nat. Mus.), 4,

Type, No. 4690, ♂, (Coll. C. H. Merriam), Uintah Mountains, south of Fort Bridger, Sept. 20, 1888, V. Bailey.

The Uintah series of 11 specimens presents comparatively little variation in either size or color. Some are a little paler and grayer than others, but the range of variation in any feature of the coloration is slight. The single July specimen is also not appreciably different.

The three specimens from the Wahsatch Mountains are a little brighter and more rufous on the sides, especially on the sides of the neck in front of the shoulders. Between these and the deepest colored example of the Wahsatch series there is, however, no very appreciable difference.

The forms most resembling this are from Helena, Montana, and San Francisco Mountain, Arizona, as will be found noted under *T. luteiventris* and *cinereicollis* respectively. It differs from true *quadrivittatus* in its much larger size, its duller, less contrasted colors, and the obsolescence of the outer dark lateral stripe.

## Tamias quadrivittatus.

(COLORADO CHIPMUNK.)

*Sciurus quadrivittatus* SAY, Long's Exped. to Rocky Mts., II, 1823, p. 45.

*Tamias quadrivittatus* WAGNER, Supl. Schreber's Säuget., III, 1843, p. 234 (in part); and of most subsequent writers, at least in part.

*Tamias quadrivittatus*, var. *quadrivittatus* ALLEN, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 289.

*Tamias asiaticus*, var. *quadrivittatus* ALLEN, Mon. N. Am. Roden., 1877, p. 793 (mainly).

*Hab.*—Mountains of Colorado and Wyoming.

*Breeding Pelage.*—Prevailing color above gray; sides slightly washed with pale yellowish brown; dark dorsal stripes blackish, sparsely mixed with pale rufous hairs; median light stripes ashy; outer light stripes clear white. This is the stage just before the moult, which apparently occurs mainly in June—probably from May into July—in which the pelage is thin, worn and faded. There are three specimens in the series before me, taken July 8–18, which are mainly in this phase, but have begun to acquire traces of the bright summer coat.

*Post-breeding Pelage* (August and September).—General color above rufous, except the head, buttocks, and thighs, the latter plumbeous gray slightly tinged with pale yellowish. Dark dorsal stripes rather broader than the intervening light stripes, blackish, mixed at the edges with bright rufous, the three middle ones continued to the base of the tail, the two outer shorter, browner, less distinctly defined, and sometimes subobsolete. The median black stripe extends forward to the hinder edge of the crown. The inner light stripes are narrow, gray, mixed slightly with rufous, and often tinged with yellow; the outer light

stripes are broader and whiter, the hairs often tipped with a wash of yellowish. Sides of the body bright yellowish rufous, darker and browner along the dorsal edge, lighter and more golden below, and extending from the hips to the sides of the neck; below clear grayish white. Facial stripes strongly contrasted, the light ones grayish white, the dark ones dusky mixed with dark rusty brown. A small grayish white patch behind the ear. Ears blackish, the front external border mixed with pale rusty, the hinder external border broadly edged with dull grayish white. Upper surface of hind feet pale buffy gray. Tail above blackish much mixed with buff; central area below buffy ochraceous, bordered with a narrow line of black, the latter fringed with the same color as the central area.

*Autumn Pelage.*—Unfortunately this is not well shown in the series before me. The nearest approach to it is seen in a specimen from Boulder County, Colorado (No. 5681, Coll. Dr. C. Hart Merriam), collected Sept. 23, 1889, by Mr. Denis Gale, and two (Nos. 5010 and 5011, Coll. C. H. M.), Oct. 12 and 13 (same collector and locality). The two October specimens have the pelage a little fuller and softer, and the tail broader and heavier than August specimens, but they scarcely differ from them in coloration. The September specimen (Sept. 28) seems to be further advanced toward winter condition than the October examples, the pelage being much softer and heavier, the colors duller and more blended, the general effect above being a dull yellowish-gray brown. The rather clear gray of the buttocks and thighs has wholly disappeared, these parts being pale yellowish brown, with a slight admixture of yellowish gray. The dark dorsal stripes are blackish, all but the median one much more brown than black, and the outer pair deep brown with a very slight admixture of dusky. This specimen, besides having lost in life the apical half of its tail, is abnormally large, and may be abnormal in coloration.

*Young* (in first coat).—Similar to the adults in post-breeding dress.

*Measurements.*—Length (average of 17 specimens measured in the flesh), 223 mm.; head and body, 115 mm.; tail vertebræ, 82 mm.; tail with hairs, 108 mm.; hind foot, 31 mm.; height of ear, 10 mm.

*Specimens examined*, 37; collected as follows: Park County, Colorado, July 7–20, 1871, J. A. Allen and C. W. Bennett (Coll. Mus. Comp. Zoöl.), 12; Boulder County, Colorado, Aug. 3–Oct. 12, Denis Gale (Coll. C. H. Merriam), 7; North Park, Idaho City, Elk Mountain, Denver, Mill City, and Sangre de Christo Pass, Colorado (1 to 2 specimens from each point—Coll. U. S. Nat. Mus.), 12; Laramie Mts., Wyoming, July 21 and Aug. 10, 1857, Dr. W. A. Hammond (Nat. Mus.), 3; Yellowstone National Park, July (Nat. Mus.), 3.

The *Sciurus quadrivittatus* of Say was based on specimens taken in Colorado, on the Arkansas River, near where it breaks through the foothills. Many of the Park County specimens are from near the original locality of Say's specimens, and this series may thus be taken as the standard for reference in considering

specimens from other localities more or less remote, as Wyoming and Montana to the northward, and New Mexico and Arizona to the southward, etc. As each series as a whole presents a more or less different *tout ensemble*, the problem is where to draw the line as to what may be best referred to a restricted *quadrivittatus* form, or to determine at what point the difference has become great enough to render its separate recognition in nomenclature desirable or profitable.

So far as the present material goes, *quadrivittatus* proper seems to occupy the main Rocky Mountain chain from near the southern boundary of Colorado northward through Wyoming to and including the Yellowstone National Park. The three specimens from Yellowstone Park, although in very poor condition, seem to indicate the presence there of a form differing considerably from that inhabiting the mountains of Central Colorado.

Three specimens from the Laramie Mountains (the first two labeled "Black Hills,* Aug. 10, 1857, Dr. W. A. Hammond;" the other "Black Hills, Neb.,* July 21, 1857, W. S. Wood,") are provisionally referred to *quadrivittatus*, although differing from Colorado specimens in much stronger tones of color throughout. A single specimen from Elk Mountain, a western spur of the main Rocky Mountains in Colorado, is also fairly typical. A single specimen in winter pelage from the Sangre de Christo Pass, near the New Mexico boundary of Colorado, is also referable here, though shading somewhat toward the San Pedro, New Mexico, series described below under the name *gracilis*. A small series from near old Fort Massachusetts, in San Luis Valley, Southern Colorado, is better referable to the pale small desert form (*consobrinus*) of the Great Basin.

## **Tamias quadrivittatus gracilis,** subsp. nov.

(San Pedro Chipmunk.)

*Hab.*—Socorro County, New Mexico, and Apache County, Arizona.

Rather larger than typical *quadrivittatus*, and of a slenderer, more attenuated form, with a longer, less bushy tail, larger ears, and very different coloration.

*Post-breeding Pelage* (July).—General color of the central portion of the dorsal region, from the front of head to the base of the tail, light gray with no general

* Not the present Black Hills in South Dakota, but what are now called the Laramie Mountains, an eastern spur of the main Rocky Mountains, north and west of Laramie City, Wyoming.

suffusion of bright rufous, as in *quadrivittatus*. The general ashy gray effect is due to the broad whitish-gray post-auricular patches, the light gray of the nape and interscapalar region, and the pure whitish gray of the light dorsal stripes, the outer two of which are clear white. The three median dark dorsal stripes are deep black, with very slight admixture of rufous at their edges. The outer pair of dark stripes, so prominent a feature in typical *quadrivittatus*, is almost obsolete—in some specimens quite absent, in others indicated by a short narrow dusky line, generally very indistinct. The sides are heavily washed with rufous, but of a duller, browner shade than in Colorado specimens. The dark facial streaks are bright rusty, somewhat mixed with blackish, but the bright rust color prevails. Front of ears broadly edged with strong rufous; nose, above the facial streaks, generally rather strongly washed with rufous; all the feet washed with rusty buff externally. Buttocks and thighs nearly as in Colorado specimens—gray, more or less faintly yellowish washed. Tail above blackish mixed with rusty; below the central area is deep orange rufous, several shades deeper than in Colorado specimens, bordered narrowly with black and with an outer fringe of buff.

*Measurements.*—Length, 245 mm.; head and body, 115 mm.; tail with hairs, 120 mm.; hind foot, 34 mm.; height of ear, 12 mm.

*Specimens examined*, 16; collected as follows: San Pedro, New Mexico, July 2–8, Vernon Bailey (Dept. of Agric.), 9; Apache County, Arizona, May 25–31, H. J. M. (Coll. C. Hart Merriam), 7.

Type, No. 17,144, ♀, San Pedro, New Mexico, July 4, 1889, V. Bailey (Coll. U. S. Dept. Agric.).

This form differs from true *quadrivittatus* in its much more grayish and less rufous color above, the purer white and gray of the light dorsal stripes, the absence or obsolescence of the outer pair of dark dorsal streaks, the prevalence of rusty in the dark facial stripes, and the conspicuously rusty rufous of the front edge of the ears; also in being somewhat larger.

The lightest-colored examples of the Colorado series and the most rufous examples of the San Pedro series are quite similar in general effect, but the former may be distinguished by having five well-defined dark dorsal streaks instead of three.

The San Pedro series presents some variation, apparently due mainly to age. Three immature, though nearly full grown specimens, are more ashy gray above, and of a duller shade of brown on the sides; they also have a quite distinct line of dusky below the outer white dorsal stripe. The outer dusky line is absent in four of the nine specimens, rather distinct in two (the youngest of the series), and slightly indicated in the other three.

To this form I also refer a series of seven specimens from Apache County, Arizona, about two hundred miles west of San Pedro, and in a somewhat similar region of country. This series was taken during the last week in May (May 25–31), during the spring moult, and is thus instructive as indicating the changes of color resulting from season. Four of the specimens are adults, two of them in a worn patchy condition of pelage; the other two are still almost wholly in the faded pelage of late spring. The other three specimens are young, about one-third to one-half grown. In none of the seven specimens is there a lateral dusky line below the usual outer white dorsal streak. The bright rufous tint on the ears and in the dark facial streaks is strongly developed. The young specimens do not differ much in color from adults in fresh summer pelage. No. 4247 (Coll. C. H. M.), ♂ ad., has about half acquired the fresh bright summer coat, and thus closely resembles the brighter specimens of the San Pedro series (*e. g.*, No. 17,144). No. 4246 (Coll. C. H. M.), ♂ ad., is less advanced toward the summer coat, broad patches of which cover the shoulders and anterior dorsal region, with smaller patches on other parts. A large part of the body retains the worn bleached winter coat. In Nos. 4245, ♂ ad., and 4248, ♀ ad. (Coll. C. H. M.), there is as yet very little trace of the new coat; the pelage is worn and so much faded as to give a pale yellowish gray effect, very different from the tints of the fresh summer coat.

## **Tamias quadrivittatus luteiventris,** subsp. nov.

(Buff-bellied Chipmunk.)

*Tamias quadrivittatus*, var. *quadrivittatus* Allen, Proc. Bost. Soc. Nat. Hist., XVI, 1874, p. 289 (in part).

*Tamias asiaticus*, var. *quadrivittatus* Allen, Mon. N. Am. Roden., 1877, p. 793 (in part).

*Hab.*—Main chain of the Rocky Mountains in Montana, from Helena northward, probably into British America.

*Post-breeding Pelage* (August).—General color above gray mixed with rufous, gray prevailing on thighs, lower back and nape. Sides heavily washed with ferruginous, extending from the hip to the sides of the neck, strongest on the flanks and paler on the shoulders. *Ventral surface buff*, varying to orange buff, stronger posteriorly. Dark dorsal stripes five, black, edged with rufous, especially anteriorly, the outer pair short but well defined, sometimes black, more fre-

quently mixed with rufous. Middle pair of light stripes gray, the hairs subapically ringed with pale rufous, which sometimes shows through the surface, giving to the gray a slight vinaceous effect; outer pair nearly pure white, sometimes tinged yellowish. Tail full, bushy; above mixed black and buff, the hairs being broadly ringed with buff near the base (extreme base black), then more broadly with black, and tipped with strong yellowish buff. Ears of medium size, externally blackish, tinged with pale rusty anteriorly and with a very broad buffy white posterior border; inner surface grayish buff. Post-auricular patches small, grayish or buffy white. Upper surface of feet orange buff, which color strongly tinges the inner side of both fore and hind limbs.

*Measurements.*—Helena series: Length, 243 mm.; head and body, 128 mm.; tail vertebræ, 93 mm.; tail with hairs, 117 mm.; hind foot, 33 mm.; height of ear, 11.5 mm. (Average of 14 specimens, measured in the flesh by Dr. Merriam.)

Chief Mountain Lake series: Length, 229 mm.; head and body, 112 mm.; tail vertebræ, 92 mm.; tail to end of hairs, 117 mm.; hind foot ("sole"), 32 mm.; "height of ear above notch," 16 mm. (Average of 10 specimens, measured in the flesh by Dr. E. Coues.)

Type, No. 11,991 (Coll. Nat. Mus.), ♂ ad., Chief Mountain Lake, Aug. 24, 1874, Dr. E. Coues.

*Specimens examined*, 28; collected as follows: Chief Mountain Lake, Montana, Aug. 19–26, 1874, Dr. E. Coues (Nat. Mus.), 10; Helena, Montana, Aug. 13–16, 1888, Dr. C. Hart Merriam (Coll. C. H. M.), 14; Mystic Lake, Montana, Sept. 28, 1888, C. W. R. (Coll. C. H. M.), 2; Birch Creek Cañon, Choteau Co., Montana, April, 1889, J. B. Monroe (Coll. C. H. M.), 1; Glacial Lakes, Northwestern Montana, Oct. 4, 1888, Dr. G. B. Grinnell (Am. Mus.), 1.

The ten specimens from Chief Mountain Lake, collected Aug. 19–26, and representing the post-breeding phase of pelage, are very uniform in coloration and size. The two specimens from Mystic Lake, taken a month later, are in little fuller, softer pelage, but present no color variation of note. The single specimen taken at Glacial Lakes, Oct. 4, is in still heavier pelage, and is rather more strongly colored, all the tints being deeper, the black of the dorsal streaks being intense black, the sides orange rufous, and the light stripes are more mixed and washed with yellowish rufous. This specimen doubtless represents the full soft pelage of autumn. There are no specimens in the pelage of spring, which would doubtless be paler and grayer.

The Helena series, taken at the same season (Aug. 13–15), differs very appreciably from the Chief Mountain Lake series, being grayer above, less strongly colored on the sides, and rather

less fulvous below, and with rather larger ears. The difference is quite striking, in the average, but not wholly constant.*

This form differs from all others in the strong buffy wash of the whole ventral surface, and in the somewhat vinaceous character of the gray of the general ground color above. Its nearest ally is *borealis* of the adjoining region to the eastward, between exceptionally bright-colored specimens of which, and very pale examples of *luteiventris*, there is very little difference in the coloration of the dorsal surface. In the latter, however, the light dorsal stripes are grayer, and all the colors stronger and purer in tone; the ochraceous wash below is absent in *borealis*. While the average difference between the two forms is very striking, judged by the material at hand, it is probable that a series of specimens connecting the localities now represented in the collection will show that the two forms thoroughly intergrade somewhere in the intermediate region. In fact, some of the paler Helena specimens very closely approach some of the brighter Deadwood specimens.

Again, larger size, much duller colors, and the yellowish wash below are the chief distinctions between *luteiventris* and Colorado specimens of true *quadrivittatus*. *T. umbrinus* (from the Uintah and Wahsatch Mountains) differs in its much larger size, the dull fuscous brown of the sides, and clear whitish gray of the ventral surface.

## **Tamias quadrivittatus affinis,** subsp. nov.

(Columbian Chipmunk.)

*Hab.*—Interior of British Columbia, east of the Cascade Mountains.

Similar in coloration to true *quadrivittatus*, but larger. Head and body (average of 10 specimens), 125 mm., against 115 mm. in *quadrivittatus* (average of 10 specimens); tail with hairs, 120 mm., against 107 mm. in *quadrivittatus*; hind foot, 31.5 mm., against 30 mm. in *quadrivittatus*; height of ear, about 10 mm., as in *quadrivittatus*.

*Spring Pelage* (April 26–29).—Coat soft, very long and full. General color above yellowish-gray brown, dark and dull; sides, including sides of the neck, dull strong brownish ochre; below dull grayish white, with a slight fulvous tinge.

* The apparent difference in size indicated by the measurements given above is due doubtless to difference in the methods of measuring. Judging by the skins, the specimens from Chief Mountain Lake appear to be the larger, the skins being over-filled and the Helena skins under-filled.

Light facial streaks brownish white; dark ones dull brown—dark rusty brown mixed with blackish. Dorsal dark stripes deep black; median light stripes gray, mixed with yellowish or rufous; outer light stripes dull yellowish white. Tail full and bushy; above mixed black and pale ochraceous; below, central area orange rufous, narrowly edged with black, and broadly fringed with pale ochraceous; hind feet above strong rusty buff. This is doubtless the winter coat, not much, if any, changed by fading.

*Breeding Pelage* (June and early July before the spring moult).—Pelage scant, thin, much worn, and greatly faded. General color above ashy gray; sides faintly washed with yellowish, sometimes so slightly as to give the general effect of yellowish gray. Dorsal dark stripes intense black; median light stripes ashy; outer light stripes pure white. Tail thin and much worn, the outer fringe of yellowish tipping the hairs mostly worn away, and the central area below pale yellowish rufous. Upper surface of hind feet pale buffy gray.

*Post-breeding Pelage* (July and August phase, immediately after the completion of the moult).—Above general color gray, suffused with yellowish rufous, except rump and thighs, which are ashy gray; sides deep ochre, varying in different specimens from bright yellow ochre to reddish ochre. Facial stripes similar to the early spring phase, except that the light ones are a little whiter, and the dark ones more reddish. Dorsal stripes intense black; median light stripes whitish gray mixed and edged with rufous; outer light stripes white, with a faint yellowish tinge; feet nearly as in early spring specimens.

*Young of the Year.*—Similar to adults in post-breeding pelage; all the colors rather duller, especially on the sides, and the general effect above more ashy gray.

Type, No. 2019, Am. Mus. Nat. Hist., Ashcroft, B. C., June 18, 1889, C. P. Streator.

*Specimens examined*, 15; collected as follows: Port Moody and Burrard Inlet, British Columbia, Apr. 26 and 29, J. C. Macoun (Coll. C. Hart Merriam), each 1; Kamloops, B. C., June 18 (young) and June 20 (adult), J. C. Macoun (Coll. C. H. M.), 2; Ashcroft, B. C., June 18–19 and July 3–8, C. P. Streator (Am. Mus.), 10; "Columbia River, Oregon, J. K. Townsend," Summer (Nat. Mus.), 1.

One of the most surprising developments in the present study is the close resemblance in coloration of British Columbia and Colorado specimens, specimen after specimen in the one series finding almost its exact counterpart in the other. There are relatively fewer specimens in the gray phase in the Colorado series, and these few are much less gray than are the corresponding British Columbia specimens.

The series from Ashcroft, B. C., consists of 10 specimens, six of which were taken June 18 and 19, and four July 3–8. There

are also two taken at Kamloops, B. C., June 6–8. Of these 12 specimens five are in the post-breeding pelage and correspond in character of coat with July and August specimens from Colorado, and also in coloration, except that the central area of the lower surface of the tail is much paler. Of the remaining seven one is clearly an intermediate, and at the same time in the midst of the moult, having acquired about half of the fresh bright summer coat while retaining much of the faded old pelage. Three others are evidently young of the year (one of them being less than half grown), and much paler (the rufous wash paler and less in amount, giving a grayer general effect). The other three (two females and one male) are in the extreme gray phase above described, due to long retention of the winter coat, these specimens showing here and there a few bright hairs of the approaching summer coat.

On turning to the Colorado series, the three specimens showing extreme grayness, and corresponding to the gray phase from British Columbia, prove on close examination to have tufts and patches of the bright coat of summer mixed here and there with the faded winter dress and partly concealed by it. As these specimens are accompanied by others in full summer dress collected on the same dates, it follows that the time of moult varies greatly in different individuals, probably at least five or six weeks, and also that what on hasty inspection seems like a clear case of dimorphism is due simply to the seasonal change of pelage. It would seem also from the present material that the worn faded coat is retained longest by the nursing females.

I recognize the British Columbia form under a special name for three reasons; first, the considerable difference in size; second, its remote geographical separation from the true *quadrivittatus;* and, third and not least, the fact that it is wholly cut off from *quadrivittatus* by several intervening forms very unlike either. This may or may not be considered a philosophical treatment of the case, according to the point of view; yet it seems a rational way of recognizing the leading facts involved.

Aside from the distant Colorado form, it seems to have, in the material at hand, no very close resemblance to other forms. It needs no comparison with *T. townsendii*, its near neighbor on the west. It is much larger than *amœnus*, the neighboring form to the

southward, and very different from it in color *at all seasons.* It shows no indication of intergradation with the Rocky Mountain form (*luteiventris*) to the eastward ; but there is no material to show what occupies the intervening region.

## **Tamias quadrivittatus neglectus,** subsp. nov.

(LAKE SUPERIOR CHIPMUNK.)

*Tamias quadrivittatus* AGASSIZ, Lake Superior, 1850, p. 52 (Ontario, east end of Lake Superior).

*Tamias asiaticus*, var. *quadrivittatus* ALLEN, Mon. N. Am. Roden., 1887, p. 793 (in part).

*Hab.*—Northeastern Minnesota, Northern Wisconsin, northern peninsula of Michigan, and northern shore of Lake Superior.

*Summer* (*Post-breeding*) *Pelage.*—Similar in general coloration to true *quadrivittatus* from Colorado, but rather redder on the sides, and generally less gray above, particularly on the rump and thighs, and with the lower lateral dark stripe blacker and stronger. Size apparently rather larger.*

Type, No. 1575, Mus. Comp. Zoölogy, eastern end of Lake Superior, July 5, 1848, L. Agassiz.

*Specimens examined*, 7 ; collected as follows : Eastern shore of Lake Superior, summer of 1848, L. Agassiz (Mus. Comp. Zoöl.), 2 ; North Pacific Junction, Minn. (western end of Lake Superior), July 10, 1877, Dr. T. S. Roberts (Coll. C. H. Merriam), 2 ; Escanaba, Mich., June, 1883, Wm. Palmer (Nat. Mus.), 3.

Unfortunately the Escanaba specimens have been badly discolored by immersion for a time in some kind of antiseptic solution and are thus of little account for purposes of comparison, while the Minnesota specimens are not fully grown, and the same is true of one of the Lake Superior specimens.

The coloration, while similar to that of Colorado specimens of corresponding age and season, is appreciably different, the general tone being duller and heavier, with the dorsal black streaks blacker and sharper, particularly the outer one.

On geographical grounds it would be expected that the Lake Superior form would be closely allied to, if not identical with, the northern form *borealis*, from which, however, it differs widely. While *borealis* is the dullest and palest of the *quadrivittatus* group, *neglectus* is one of the brightest and strongest colored, the average difference between *neglectus* and *borealis* being very striking ;

* The specimens are not in condition to admit of satisfactory measurement.

much greater than between *neglectus* and true *quadrivittatus* from Colorado, though separated from the latter by over a thousand miles of territory and two intervening forms. Doubtless it will be found to intergrade at the northward with *borealis*.

The specimen here taken as the type of *neglectus* was collected by the late Professor L. Agassiz, in 1848, on his memorable Lake Superior Expedition. It is labeled, in Agassiz's handwriting, "Lake Superior, 1848." In the narrative of the tour (l. c., p. 52) is this reference, under date of July 5, the locality being the mouth of Montreal River, at the eastern end of Lake Superior. "One of our men killed here a squirrel of the kind that takes the place of our 'Chipmunk' in these regions, the *Tamias quadrivittatus*. . . . We found it afterwards much more abundant than any other species, particularly on hill-sides among broken rocks, attracting the attention by its loud, peculiar cry." Two specimens, now in the Museum of Comparative Zoölogy, were brought home by Professor Agassiz, one of them a nearly full-grown young of the year, the other adult, nearly in post-breeding dress, with the coat still thin but the colors strong.

From the localities given above, and Dr. Hoy's record of its occurrence in northeastern Wisconsin, this form is doubtless common throughout the region bordering Lake Superior, including the contiguous portion of the Province of Ontario, most of the Northern Peninsula of Michigan, northern Wisconsin, northeastern Minnesota, and thence northward to the habitat of *borealis*.

## Tamias quadrivittatus borealis.

(Northern Chipmunk.)

*Tamias quadrivittatus*, var. *pallasi* Allen, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 290 (in part—excluding Siberian references).

*Tamias asiaticus*, var. *borealis* Allen, Mon. N. Am. Roden., 1877, p. 793 (in part—American references only).

*Hab.*—Northern North America, east of the Rocky Mountains, from near the northern boundary of the United States northward; also Turtle Mountain, North Dakota; Black Hills, South Dakota; and Bear's Paw Mountain, Montana.

*Autumn Pelage.*—General color above a dull pale yellowish gray, with five broad, strongly pronounced black streaks, the outer pair short but broad and well defined. Median light stripes yellowish gray; outer light stripes white,

faintly tinged with yellowish. Sides faintly washed with yellowish brown; buttocks and thighs dull yellowish gray; ventral surface rather clear grayish white, sometimes with a faint tinge of buff posteriorly. Light facial stripes grayish white, the dark ones blackish, edged and somewhat mixed with dark rusty brown. Central area of tail below pale orange, bordered narrowly with black and fringed with yellowish.

*Breeding Pelage.*—Much paler than the autumn pelage; above ashy gray with a faint shade of yellowish; sides with only a very pale yellowish wash; dark dorsal stripes darker, less mixed with pale rufous; median light stripes more ashy, the outer ones clearer white. Pelage thin and worn.

The early spring phase is not represented.

*Measurements.*—Length (average of 14 Dakota specimens measured by the collector in the flesh), 206 mm.; head and body, 114 mm.; tail with hairs, 92 mm.; hind foot, 32 mm.; ear (measured from skins), 9 mm.

*Specimens examined*, 36; collected as follows: British America (Fort Resolution, 3; Nelson River, 2; Peace River, Mackenzie River, Fort Liard, and Fort Simpson, 1 each (Nat. Mus. and Mus. Comp. Zoöl.), 9; Fort Pembina, June 4, 1873, Dr. E. Coues (Nat. Mus.), 1; Bear's Paw Mountain, Mont., July 25, 1874, Dr. E. Coues (Nat. Mus.), 1; Pleasant Valley, Mont., June 29, 1871, F. J. Huse (Nat. Mus.), 1; Bottineau, Turtle Mountain, North Dakota, Aug. 23–26, 1887, Vernon Bailey (Coll. C. H. Merriam), 8; Deadwood, Black Hills, South Dakota, Oct. 26–28, 1887, V. Bailey (Coll. C. H. M.), 10; Buffalo Gap, South Dakota, June 23, 1888, V. Bailey (Coll. C. H. M.), 1; Custer, Black Hills, July 9–14, 1888, V. Bailey (Coll. C. H. M.), 3; Wood's P. O., Medicine Mts., Wyoming, Aug. 8, 1888, V. Bailey (Coll. C. H. M.), 1.

Aside from seasonal variation, this large series is remarkably uniform in coloration. The Black Hills series is indistinguishable in color from the Turtle Mountain series, although the two localities are some six hundred miles apart, in a nearly north and south direction. The conditions of environment, however, are practically the same—an isolated group of heavily-wooded mountains rising from the plains. The Black Hills series averages, however, a little smaller in dimensions than the series from Turtle Mountain. There is also a close agreement in coloration between the specimens from the far north and those from Dakota.

Seasonal variation in color is less marked in this form than in several others, owing doubtless to its rather dull tints at all seasons. The series, however, contains very few specimens in the faded pelage of the breeding season, as it consists mostly of August and October specimens. There are only three excep-

tionally pale examples, as follows: a male (No. 1154, Coll. U. S. Nat. Mus.) taken at Pembina, June 4, and two nursing females (Nos. 4497 and 4498, Coll. C. H. M.) taken at Custer, Black Hills, S. D., July 9 and 11. The two latter already show patches of the bright summer pelage, though still in the worn bleached coat of the end of the breeding season. A third female (No. 4499, Coll. C. H. M.), taken at Custer, July 14, and evidently past the nursing period, had completed the moult, and is one of the brightest, most strongly-colored specimens in the entire series. Hence three specimens, of the same sex, taken at the same locality, and practically at the same date, cover the whole range of variation presented by the entire series, and show further how great a change in color may be due to season; and also that the time of moult varies greatly in different individuals at the same locality.

This northern form of the *T. quadrivittatus* group is intermediate in color between *T. minimus*, the small pallid form of the Plains, and typical *quadrivittatus* of Colorado. In the Dakotas it probably grades into *T. minimus*, both as regards size and coloration, although in the material before me I have no difficulty in separating the two series.

In the first use of the name *borealis* it was improperly and somewhat inadvertently allowed to cover the Old World *T. asiaticus* as well as the form of the American Fur countries. In now restricting the name to the American form I will indicate as the type specimen No. 6506 (U. S. Nat. Mus.), Fort Liard, British America, W. S. Hardisty; with which No. 3994 (Coll. C. Hart Merriam), Deadwood, S. Dakota, October 27, 1887, is practically identical.

The habitat of *borealis* is very extended; in the far north it ranges westward to the eastern base of the Rocky Mountains, and eastward to Hudson Bay, there being specimens in the collection from Fort Liard and Fort Simpson, and from Nelson River. Along our northern border it occurs in the Pembina, Turtle, and Bear's Paw Mountains, with an isolated colony in the Black Hills of South Dakota.

## Tamias minimus.

(PALE CHIPMUNK.)

*Tamias minimus* BACHMAN, Journ. Acad. Nat. Sci. Phila., VIII, 1839, p. 71.
*Tamias quadrivittatus*, var. *pallidus* ALLEN, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 289.
*Tamias asiaticus*, var. *pallidus* ALLEN, Mon. N. Am. Roden., 1877, p. 793.

*Hab.*—"Bad lands" and plains of Dakota, Montana, and Wyoming.

*Summer* (*Post-breeding*) *Pelage* (July to Sept.)—General color above light gray mixed with pale rust, except on buttocks and thighs; sides ochraceous buff, varying in different specimens from clear buff to strong ochraceous buff; below clear grayish white. Median dorsal stripe narrow, black, edged with pale rusty yellow; the other dark stripes pale rusty yellow, mixed with blackish, in some specimens the rusty yellow prevailing, in others the blackish; central light stripes whitish gray, outer ones clear white. Dark facial stripes pale yellowish brown; the light ones grayish white. An ill-defined grayish white patch behind each ear. Ears dusky, front half rust color, posterior border whitish. Tail above blackish, the hairs sub-basally ringed and tipped with ochraceous; below, central area ochraceous, varying in different specimens from pale to strong ochraceous, bordered with a line of black, fringed heavily with the same color as the central area.

*Autumn Pelage* (October).—Similar in color, except more suffused with yellow; coat softer and fuller.

*Breeding Pelage.*—A May specimen (Mauvaises Terres, May 25, 1855, Dr. F. V. Hayden), a flat skin in bad condition, has all the colors much faded, the central area of the tail pale yellowish white, the general color above similar, with the dark streaks pale yellowish brown. A Montana specimen (Sunday Creek, Montana, May 15, W. T. Hornaday) is less suffused with yellow, and has more black in the dorsal streaks; the pelage is also fuller and less worn. Three specimens from Bridger's Pass, collected May 14 and 15, 1890 (received as these pages are passing through the press), are similar, and differ from August and September specimens in having all of the tints much paler and in almost wholly lacking the buffy wash on the flanks.

*Spring? Pelage.*—Two specimens without date (Yellowstone River, below Powder River, Lt. G. K. Warren's Exploration of Nebraska), have the appearance of being early spring specimens, judging by analogy from other forms. The pelage is very soft and full, the general color above suffused with yellow or pale ochraceous, with also a faint buffy tinge on the ventral surface. The median dorsal dark stripe is very narrow and brownish black, the other dark stripes brownish ochraceous, scantily mixed with blackish; median light stripes ochraceous buff, faintly mixed with gray; the outer ones yellowish white. In other words, similar to the May specimen above described, except that the coat is fuller and softer, with a stronger ochraceous wash over the whole dorsal surface.

*Measurements.*—Size small; ears medium. Length (average of 10 specimens measured in the flesh by the collector), 200 mm.; head and body, 125 mm.; tail vertebræ, 85 mm.; tail with hairs, 105 mm.; hind foot, 29 mm.; height of ear, 8 mm.

*Specimens examined*, 32; collected as follows: Lower Yellowstone River, May and August, Dr. F. V. Hayden (Nat. Mus.), 4; Upper Missouri, Prince Maximilian (Am. Mus.), 1; Camp Thorne, Lower Yellowstone River, July 18, 1873, J. A. Allen, 2; Sunday Creek, Montana, May 15, 1886, W. T. Hornaday (Nat. Mus.), 1; Calf Creek, Montana, Oct. 16, 1887, Jenness Richardson (Am. Mus.), 1; Green River, Wyoming, Aug., Sept., and Oct. (various Government Expeditions—Nat. Mus.), 6; Green River City, Wyoming, Sept. 12–13, 1888, V. Bailey (Coll. C. H. Merriam), 4; Bridger's Pass, Wyoming, Sept. 1–3, 1887, V. Bailey (Coll. C. H. M.), 3; Bridger's Pass, Wyoming, May 14, 15, 1890, V. Bailey (Dept. of Agric.), 3; Bitter Creek, Wyoming, Oct. 13–16, 1874, Dr. F. V. Hayden (Nat. Mus.), 5; "West Humboldt Mts., Nevada, Oct., 1867, R. Ridgway" (Nat. Mus.), 1.

This is a pallid, depauperate form of the Badlands and more or less open country of the Upper Missouri and Yellowstone region, and the plains of Southern Wyoming. It is easily distinguishable from the neighboring forms of the region to the northward and southward by its small size and pallid colors, but is more nearly related to the pallid forms of the Great Basin, with which it probably intergrades. Its habitat is continuous from near the boundary line of Southwestern Wyoming eastward and northward to the lower Yellowstone and Missouri Rivers.

A single specimen labeled as from the West Humboldt Mountains, Nevada, is indistinguishable from specimens taken at the same season in Southern Wyoming. Specimens from near Fort Bridger and Ogden, however, and also from the Great Basin west of Great Salt Lake, are quite different from the Green River series and those from Eastern Montana, and are respectively referable to two other desert forms characterized below under the names *consobrinus* and *pictus*. These two forms probably intergrade with each other and with *minimus* along the lines of junction of their respective habitats, and are consequently treated as subspecies of *minimus*, though their actual intergradation is not shown by the material at present available.

It is not improbable that intergradation between *minimus* and *borealis* may occur in portions of Montana and Dakota, but in the

absence of satisfactory evidence that such is the case, and in view of the wide difference in size and the striking difference in coloration between *minimus* and *quadrivittatus* proper, it seems best for the present to treat them as specifically separable.

Bachman's *Tamias minimus* has hitherto been considered as based on a young example of the common *T. quadrivittatus*, collected by Mr. J. K. Townsend in 1834, the locality, "Rio Colorado," being rather misleading. Bachman quotes Townsend's notes as saying: "It is found very plentiful along the banks of the Rio Colorado, but, I think, does not inhabit a very extensive range, as I never saw it after leaving the river." Townsend, in his "Narrative of a Journey across the Rocky Mountains to the Columbia River," etc., says, under date of June 19 (p. 72), "We arrived to-day on the Green River, Siskadee, or Colorado of the West." The context shows that this point was not far from the junction of Ham's Fork, in southwestern Wyoming, and hence not far from Green River City. This and neighboring localities are well represented in the present material, as well as in that on which the subspecies *pallidus* was originally founded. Besides, Bachman's description of *T. minimus*, based on a June specimen, accords well with the breeding phase of what I have hitherto called *pallidus*, which name must obviously now be treated as a pure synonym of *minimus*.

## **Tamias minimus consobrinus,** subsp. nov.

(Wahsatch Chipmunk.)

*Tamias asiaticus*, var. *pallidus* Allen, Mon. N. Am. Roden., 1887, p. 793 (in part).

*Hab.* — Eastern border of the Great Basin (Eastern Utah, Western and Southern Colorado, and Northwestern New Mexico).

*Breeding Pelage* (April–June).—Above gray mixed with pale rufous and blackish; sides very faintly washed with pale buff; below grayish white. Dark dorsal stripes five, all sharply defined, the median one black slightly edged with pale rust; the next on either side broader, less black and more mixed with rust, giving the effect of light seal-brown; outer pair rusty brown, varied with dusky, the general effect being yellowish-chestnut brown. Median pair of light stripes light gray; outer pair broader, white. Light facial stripes grayish white, broad; dark ones narrow, pale brown varied with dusky, not sharply defined. External surface of ears black centrally, edged in front

with pale rufous and gray, the posterior border broadly yellowish white, of the same color as the small post-auricular patches. Tail above black varied with yellowish white, the hairs being ringed narrowly with buff at the base, then broadly with black, and tipped with pale yellowish white ; below, central area deep buff, broadly bordered with black, with an outer fringe of pale yellowish white. Feet pale grayish buff.

*Post-breeding Pelage* (Sept.–Oct.).—Above gray, varied with rusty and black ; sides with a strong wash of yellowish brown ; below white tinged fainly with buff. Dorsal stripes strongly contrasted ; the median dark one black, faintly edged with rusty, the others seal brown varied with rusty ; median pair of light stripes gray varied with rusty yellow, the outer pair white with a faint yellow tinge. Tail as in the breeding pelage, except that the central area is more rusty and the tips of the hairs much more strongly yellow.

*Measurements.*—Length (collector's measurements from fresh specimens), 203 mm.; head and body, 105 mm.; tail vertebræ, 90 mm.; tail to end of hairs, 103 mm.; hind foot, 30 mm.; height of ear (in skins), 8 mm.

Type, No. 4883 (Coll. C. Hart Merriam), ♂ ad., Wahsatch foothills near Salt Lake City, Utah, Oct. 31, 1888, Vernon Bailey.

*Specimens examined*, 22 ; collected as follows : Camp Scott, Utah, April 6–June 4, 1858, C. Drexler (Nat. Mus.), 4 ; Fort Bridger, Wyoming, July, 1872, E. W. Nelson (Coll. C. Hart Merriam), 1 ; Uintah Mts., thirty miles south of Fort Bridger, Wyoming, Sept. 20, 1888, V. Bailey (Coll. C. H. M.), 2; Fort Bridger, Wyoming, May 22–30, 1890, V. Bailey (Dept. of Agric.), 8 ; Henry's Fork of Green River (near Fort Bridger), Oct. 2, 1870, H. D. Schmidt (Nat. Mus.), 1; Wahsatch foothills, eighteen miles east of Salt Lake City, Utah, Oct. 31, 1888, V. Bailey (Coll. C. H. M.), 1 ; Utah, H. W. Henshaw (Nat. Mus.), 1 ; Fort Massachusetts, Southern Colorado (no date), Capt. Bowman (Nat. Mus.), 4.

Of the 22 specimens above recorded 10 were before me when preparing the revision of the genus *Tamias* published in 1877 (l. c.), and were considered as "intermediates" between *quadrivittatus* and *pallidus* (= *minimus* Bach.) They are very poor, partly filled, distorted skins of the small size characterizing *minimus*, paler and quite different in coloration from *quadrivittatus*, and also very different from true *minimus* of the plains of Southern Wyoming and the Upper Missouri and Yellowstone. In the light of present material it seems necessary to recognize three pallid forms instead of one ; namely (1) true *minimus* (= *pallidus* Allen) of the Upper Green River, Missouri, and Yellowstone regions, (2) *consobrinus* of the eastern border of the Great Basin region.

and (3) *pictus* of the Great Basin at large, except the eastern border.

From *minimus* this form differs in its somewhat larger size and in its decidedly stronger colors throughout, the gray of the upper parts being of a purer ashy instead of fulvous gray, including the median pair of light stripes ; the outer light stripes are whiter, and the dark stripes blacker ; the wash on the flanks is a strong yellowish brown instead of buff. The contrast in color in the post-breeding phase is striking, but in the bleached pelage of May the difference is less strong, both forms at this season almost wholly losing the strong buff or brownish wash on the flanks ; *consobrinus*, however, may be still distinguished by the much greater amount of rufous and its more rusty tint in the dark dorsal streaks, particularly in the outer one ; in *minimus* the dark streaks being dusky mixed slightly with pale yellowish brown, while in *consobrinus* they are blackish strongly mixed with chestnut brown, the outer streak being often almost wholly of this tint. This is the average difference, but, owing to the considerable range of individual variation in the two forms, I find occasionally, in the May series of specimens, a specimen from near Fort Bridger (*consobrinus*) that cannot be readily distinguished from others from Bridger's Pass (*minimus*), showing that in this region the two forms evidently intergrade, as would be expected, this being where their respective habitats merge.

It holds a singular relationship to *T. umbrinus*, the range of the two forms apparently meeting in the foothills of the Uintahs, and of the Wahsatch range east of Ogden and Salt Lake City. They resemble each other in color, except that *umbrinus* lacks the outer pair of dark dorsal streaks, which are well developed in *consobrinus*. There is, however, an enormous difference in size between the two forms, *umbrinus* being nearly twice the size, as regards bulk and weight, of *consobrinus*.

The habitat of *consobrinus* includes the region bordering the Uintah and Wahsatch ranges, from Fort Bridger and Ogden southward, probably including the thinly-wooded country of northwestern and western Colorado, and southward and eastward to the San Luis Park, and portions of northern New Mexico. Four specimens from old Fort Massachusetts (near the present

site of Fort Garland), Colorado, agree very closely with specimens from near Fort Bridger and the vicinity of Salt Lake City, but are still somewhat different, the dark dorsal streaks being more heavily edged with a more yellowish rufous, and the flanks more heavily washed with a more golden shade of rufous.

## **Tamias minimus pictus,** subsp. nov.

(Desert Chipmunk.)

*Hab.*—The Great Basin, from the western border of Great Salt Lake westward, and from Southern Utah and Southern Nevada to the Snake Plains of Eastern Washington.

*Post-breeding Pelage* (Sept. and Oct.).—Above general color slate gray; sides washed, generally faintly, with yellowish buff, confined almost wholly to the region between the hips and shoulders, the latter being clear slate gray, with only the faintest shade of pale buff on the sides of the neck, which are always much paler than the flanks; ventral surface silvery white. Five very distinct dark dorsal streaks, the central one black, the others dark seal brown, edged slightly with rufous; median light stripes slate gray, the outer pair nearly pure white. Facial stripes well defined, the light ones grayish white, the dark ones dusky varied with a slight admixture of dark rufous. Ears externally with the front half blackish, slightly mixed on the edge with rusty; posterior border broadly whitish. Post-auricular patches small, indistinct, whitish. Feet gray, faintly washed with very pale buff. Tail above mixed black and gray or yellowish gray, the hairs being black at the extreme base, then ringed broadly with pale buff and black and tipped with pale yellowish gray; central area below dark yellowish buff, narrowly edged with black, the latter fringed with yellowish gray.

*Breeding Pelage* (May).—Similar to the post-breeding (autumn) pelage but the colors all much paler, and the dark dorsal streaks more rufous.

*Young* (half grown).—Colors similar to those of adults in autumn, but the sides rather more washed with yellowish buff, and the pelage thinner and more silky.

*Measurements.*—Length (measured in the flesh), 219 mm.; head and body, 110 mm.; tail vertebræ, 89 mm.; tail to end of hairs, 109 mm.; hind foot, 29 mm.; height of ear, 8 mm.

Type, No. 4882 (Coll. C. Hart Merriam), ♂ ad., Kelton, Utah, Oct. 25, 1888, V. Bailey.

*Specimens examined*, 8; collected as follows: Carson, Nev., May 16, 1881, W. E. Bryant (Coll. C. H. Merriam), 1; same locality and collector, June 9, 1887 (Cal. Acad. Sci.), 1; same locality, May 24, 1889, C. A. Keeler (Dept. of Agric.), 2 (young); Kelton, Utah, Oct. 25, 1888, V. Bailey (Coll. H. M.), 2; North Yakima, Wash., Sept. 25, 26, 1889, T. S. Palmer (Dept. of Agric.), 2.

*Tamias pictus* is closely related to *T. consobrinus* and *T. minimus*, they all agreeing very closely in size and greatly resembling each other in coloration, all being pallid forms of the nearly treeless plains and deserts, but occupying quite distinct physical areas. *T. pictus* is easily distinguished from the others by the rather pure deep slate gray of the dorsal surface, and the very slight buffy suffusion of the flanks, as compared with either of the other forms, and the very slight amount of rufous bordering the dark dorsal streaks. It is eminently a desert form, inhabiting the greater part of the Great Basin. The present material is too limited to define satisfactorily either its distribution or its relationship to *consobrinus* and *minimus*. The series of specimens is limited to two or three examples each from three widely separated localities—Carson, Nevada, Kelton, Utah (near the northwestern corner of Great Salt Lake, in the "desert,") and North Yakima, Washington, near the arid plains of the Columbia. Yet the specimens from these distant points are exactly similar.

ARTICLE V.—*Observations on a Fossil Fish from the Eocene beds of Wyoming.* By R. P. WHITFIELD.

One of the fossil fishes obtained from the Eocene deposits of Twin Creek, Wyoming, for the Museum collection, has been for some time without name, as I had not been able to identify it with any description which I had seen, until Dr. J. S. Newberry called my attention to that of *Notogoneus osculus*, Cope, described in the Am. Naturalist for November, 1885, p. 1091, and in the Seventeenth Memoir of the National Acad. of Sciences, of about the same date, where the author has also given a figure of the species. The specimens there described has been the foundation for a generic as well as a specific name, and has been referred by its author to the Isospondylous fishes, near *Gonorhynchus*, a genus now living in South Africa, and South and West Australia, and in Japan. In my studies of the specimen in the collection of the Museum, I had come to the conclusion that it belonged near to a very different class of fishes, and one that is now extremely abundant in the rivers and streams of our own country, namely the *Catostomidæ*, or Suckers, common in nearly every fresh water stream of the Northern States. There are several features of the species which do not conform to the requirements of the characters ascribed to that family, such as the scales on the head, and even the character of the scales themselves, in being setose on their exposed border; the great size of, and features pertaining to the opercular series, and particularly the great anterior extension of the frontal bones of the head; but in the general form of the head and mouth bones, in the absence of an adipose fin, and in the form and proportions of the body it very closely resembles our common Sucker, *Catostomus Commersoni*, Lacepedes. So very strong are some of these resemblances, namely the size and form of the intermaxillary and maxillary bones, and dental bones, as I have interpreted them, that admitting these features, its Catostomoid character and alliance is at once seen, but the bones of the skull differ materially. There are certainly many features also in which it closely resembles *Gonorhynchus*, especially in the structure of the scales, and in having the head par-

tially or entirely covered with them, and the great length of the frontal bones of the skull. But here, as far as general appearance goes, the resemblance ends. There are several discrepancies between the specimen which I have studied and that described and figured by Prof. Cope under the name given above, and some differences of interpretation of organs seen, as follows: The small trifid bone at the end of the muzzle I had supposed to be the intermaxillary, as it so closely resembles that bone in the common Sucker, and the elongate flattened bone below it I had identified as the maxillary. The first of these Prof. Cope has considered as a spicule for the support of barbels on each side of the mouth. In the Museum specimen I have found only two branchiostegal rays; they are very strong and robust, while Prof. Cope's figure shows four, and his description gives "three or four" for the family character. There are also strong distinctions between the specimen and his figure in the features of the opercular series, and in the fin ray formula as between his description and our specimen. Judging from Prof. Cope's figure, I think there are parts on the anterior portion of the head of the Museum example which have been lost from the one he figures, and which may have some bearing on its classification. Of these, the ethmoid, or what I have thought to be the ethmoid, separates the anterior ends of the frontals, being elongate wedge-formed at that end, but expands laterally in front, and is margined in front and laterally by what may represent the parethmoids. The following description of the specimen will serve to elucidate the features mentioned:

Body elongate and slender, the extreme length equaling about five times the depth as taken in front of the dorsal fin; the length of the tail fin equals that of the head and gill covers, and each forms about one-fifth of the entire length; total length as seen on the slab about twenty-two inches, or fifty-five centimeters. Head slender, protracted in front of the orbital region; fins proportionally small as compared with living species of Catostomus, the dorsal and anal are broadly triangular, the pectoral rather narrow and the ventral less narrowed; dorsal with seventeen or eighteen fully developed rays, and three short anterior rays; pectorals twelve rayed; ventral twelve, and one short

anterior ; anal twelve, one short ; caudal twenty fully developed with three short ones above, and three below. Vertebral joints numerous, shorter than their diameter, except near the caudal extremity where they are nearly equally high and long. The dorsal number thirty-five, and the caudals fourteen. There are three spaces between the caudal vertebra, each of which is equal to a joint, as if they had been separated and lost, or the line extended before imbedding—if removed there must have been seventeen caudals, though I think the line has only been extended to that degree. All the internal bones of the body are slender.

Of the bones of the head the intermaxillary is very small, its lateral expansion being not more than six mm. on each side of the central line ; the maxillary seen is nineteen mm. long, very narrow at the upper end and flattened below to a width of five mm. ; dental bone triangular, deeply notched on the inner border, and the anterior and basal margins forming nearly a right angle with each other ; articular bone broadly triangular ; the main frontal bones are very long, forming more than half the length of the head ; temporal bone also large and heavy. Operculum large, trapezoidal in outline, measuring three and one-half centimeters along the vertical anterior margin below the base of the articulating spur ; suboperculum proportionally very large, semi-elliptical in outline, with the lower anterior end obliquely truncated by the interoperculum, its surface marked with deep radiating furrows for two-thirds of the distance from the outer margin toward the angle, the point from which they radiate, dividing the surface into seven lobes, and the margin into deep notches. The preoperculum is broad in the middle, and narrowed toward each extremely, the posterior and lower margins being nearly at right angles to each other, the whole being triangularly sickle-shaped. Suboperculum long, narrow in front, and spatulate behind. Branchiostegal rays, two only seen, strong, falciform. The orbital bones are not fully determined, being too much displaced and imperfect for positive description. Ethmoid bone (?) anchor-shapes, being elongate wedge-formed behind, and separating the frontals for about one-fourth of their length, then spreading laterally and margined by what may represent the parethmoids.

The scales of the body are comparatively small as compared with those of most living species of this group of fishes, and are apparently smaller near the head than behind; the number of lines cannot be determined, but they appear to have been quite numerous. Those that are seen on parts of the head, as on the opercular plate and on the lower part of the head behind the mouth, are narrow and elongated as compared with those of the body. The latter as seen on isolated individuals are subquadrangular, longer than wide, the sides being nearly straight but slightly divergent, the widest part of the scale being the anterior or inserted end; ends of the scale curved, the posterior margin slightly angular in the middle, and the border thickened; median sectional area with obscure rays, number not determined, but on one example are quite numerous and only slightly divergent, lateral sections marked by very fine, even, longitudinal lines. Posterior or external end of the scale armed by a row of curved setæ, of which twenty-four can be counted on one side of the central line, the curvature increasing as they approach the outer margin of the scale. These setæ have been very loosely attached to the scale, and are to a very great extent denuded, and lie scattered among the scales on the specimen.

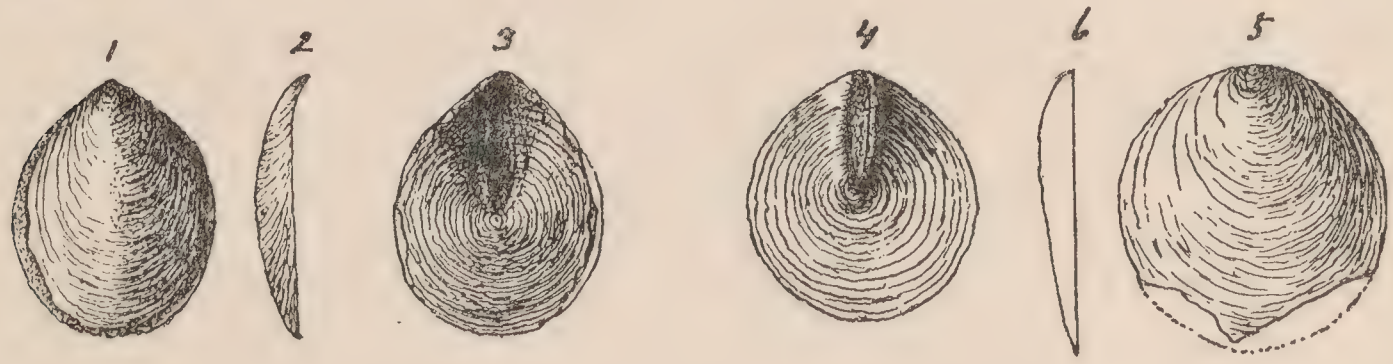
Considering the several differences between the figure and description as given by Prof. Cope and the Museum specimen, I have thought that possibly they may represent two distinct forms, in which case I should propose for that here figured the generic name *Protocatostomus*, in allusion to its Catostomoid features, and its early geological position, and for the species the name of *Constablei* in honor of our trustee, Mr. J. M. Constable, through whose liberality this and many other of the fine fossil fish from this locality has been placed in the Museum collection.

ARTICLE VI. — *Description of a New Genus of Inarticulate Brachiopodous Shell.* By R. P. WHITFIELD.

In Vol. IV of the Palæontology of New York, Part I, Pl. I, Fig. 9, Prof. Hall has figured a shell under the name *Lingula exilis*, associating it with another one, Fig. 8, from a lower geological horizon, the Marcellus shale, under the same name. Some years ago I had occasion to work over the specimens of this form, Fig. 9 cited above, in the Museum collection, and discovered that the lower valves of three individuals of the set presented the characters of *Discina*, although the upper valves were essentially *Lingulas*. Upon ascertaining this fact I took the specimen represented by Fig. 9, as above cited, which is attached to the inside of a valve of *Modiomorpha concentrica*, Conrad's sp., and lifted it from its attachment, when it was seen to possess the discinoid lower valve shown on the other three. This one, figured by Hall as a *Lingula*, is somewhat imperfect on the margins, particularly on the cardinal border, so that the features of the species are not fully shown on it. Of the several examples now in the Museum collection, some are as nearly circular as that figure, while two are quite elongate-ovate in outline, and present on the upper valve quite the characters of a species of *Lingula*, although in both of these specimens the lower valves, which are entirely exposed, are perfectly *discinoid* in character. The features of the upper valve which give it the linguloid character is the terminal or marginal beak, terminal in the elongated form, and marginal on the more circular ones, with the growth lines passing off on the cardinal border as on a *Lingula*. In the elongated forms the beak portion is bent or curved downward below the plane of the under valve and adds much to its linguloid character. Owing to this peculiarity of being linguloid on one side and discinoid on the other, I have concluded it to be necessary to separate it from both of these genera, and to propose for it a distinct generic name commemorative of its hybrid character applying to it the name *Lingulodiscina*, with the following characters.

## **Lingulodiscina,** New Genus.

An inarticulate brachiopodous shell, in which the upper valve is linguloid in character, having a marginal or an essentially terminal beak, the accretions by growth being along the lateral and basal margins; lower valve discinoid in character and having its growth lines nearly equal on all sides of the initial point and perforated on the cardinal side by a byssal slit or opening, as in *Discina*. Shell structure as in *Lingula* and *Discina*. Muscular scars yet unknown. Type, *Lingula exilis*, Hall. Geological horizon of the known species, Hamilton Group of the New York series.



Illustrations of *Lingulodiscina exilis*, Hall's sp.

Figs. 1 and 2, upper valve and profile of an elongate form; 3, the lower valve of the same specimen; 4, lower valve of another more circular specimen from the inside; 5 and 6, upper valve of a circular specimen, showing the marginal apex, and profile; 7, view of a large upper valve, the apical portion bent under and crushed, and with the lower valve showing at the base; 8, the specimen figured on Plate 1, Fig. 9, Pol. N. Y., Vol. IV, Part I.

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NOTE.—Through the kindness of Prof. J. M. Clarke, of the N. Y. State Museum, I have been able to examine the Marcellus shale type of the species, and am convinced that it is generically and specifically the same as those from the Hamilton shales.

## EXPLANATION OF PLATE 4.

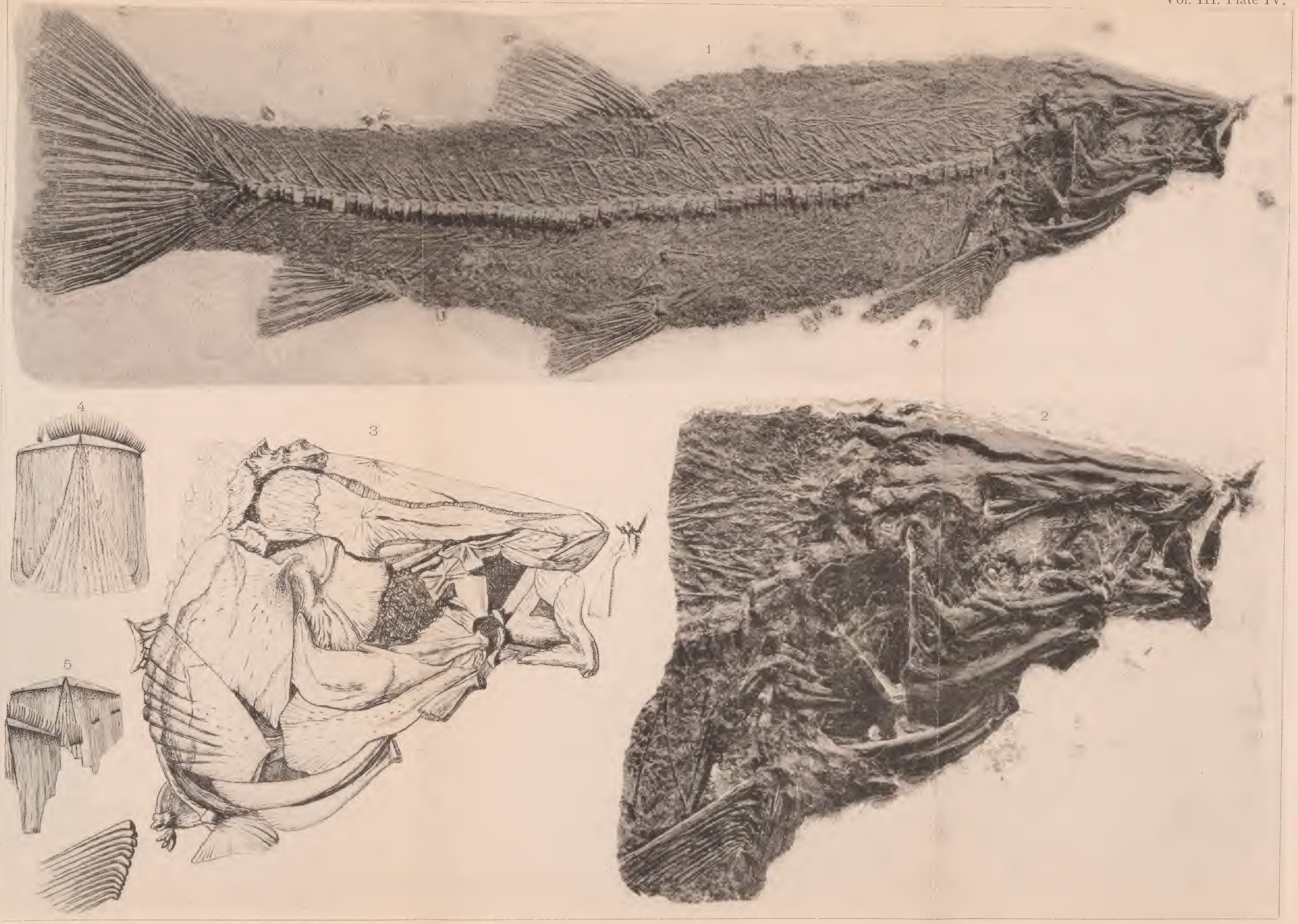
*Fig.* 1. View of the specimen of *Notogoneus osculus*, Cope? one-half the actual length, from a photograph, showing the general features of the specimen.

*Fig.* 2. View of the head and anterior part of the body natural size; also from a photograph. The intermaxillary and maxillary bones are seen slightly separated from the other mouth parts. The outline of the other parts are somewhat obscure, but with care may be traced, and with the aid of Fig. 3 may be readily deciphered.

*Fig.* 3. View of the head, nat. size, from a pen drawing given to elucidate the features, as shown on Fig. 2. In this figure the outlines of the plates are measured as accurately as possible, the only chance of error being in the possibility of mistaking the lines of sutures. These possibilities are greatest at the point of junction of the parietals, and the frontals; between the ethmoid and the parts in front of it, and between the preoperculum and quadrate.

*Figs.* 4 & 5. View of scales enlarged six diameters. In Fig. 5 there are parts of three individual scales represented, as they occur on the shale, and shows the extent to which each was exposed. The larger one has the setæ entirely removed, the left hand fragment preserves them entire, while of the third the setæ alone remain in position, a part of them being removed. These enlargements are made from the scales seen scattered along the sides in Fig. 1.

2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ARTICLE VII.—*On a Collection of Birds made by Mr. Clark P. Streator in British Columbia, with Field Notes by the Collector.* By FRANK M. CHAPMAN.

The collection on which this paper is based was made by Mr. Clark P. Streator, who visited the region under consideration in the interests of the American Museum of Natural History. Mr. Streator was in the field from April 21 to November 15, 1889, and collected about 1000 birds. The localities visited by him, with quotations from his MS. notes on their prominent physical characteristics, are as follows:

1. Westminster Junction, B. C., April 21 to May 28.

"Westminster Junction is situated about three miles from the head of Burrard's Inlet, and ten miles north of the United States boundary. The country is characterized by gigantic coniferous forests, with trees frequently reaching to the height of over three hundred feet. Underneath these trees spring up many smaller deciduous ones, such as maple, alder, and many others. In most cases the trees as well as the ground and fallen logs are laden with moss and ferns, forming an almost impenetrable mass. There is very little open country except on the overflowed lands of the Frazer River. Here there is little timber but cottonwoods and willows."

2. Mt. Lehman, B. C., May 29 to June 15, and September 4 to 23.

"Mt. Lehman is twenty miles east of Westminster Junction, on the south side of the Frazer River. This locality differed little from the former, but the timber was less dense."

3. Ashcroft, B. C., June 16 to July 15.

"Ashcroft is located one hundred miles north of the United States boundary, and two hundred miles east of the western terminus of the Canadian Pacific Railway. This place is almost a desert; only sage-brush, small cactus, and now and then a few stunted trees and plants, are to be seen. But the mountains, two thousand feet high, are covered with scattering pine forests."

4. Ducks, B. C., July 16 to September 3.

"Ducks is sixty miles east of Ashcroft. The region is covered with a scattering coniferous forest, with bunch grass growing abundantly underneath."

5. Duncan's Station, Vancouver Island, September 27 to October 10.

"Duncan's station is situated forty miles north of Victoria, on the Esquimalt and Nanaimo Railway. It is on the edge of one of the most improved and fertile valleys on the island. On all sides are numerous and extensive lakes. The land which has been cleared was formerly covered with heavy forests, which were largely coniferous."

6. Kalama, Wash., October 14 to 20.

7. Ilwaco, Wash., October 24 to November 15.

"Kalama is situated sixty miles from the mouth of the Columbia River; Ilwaco is at the mouth of this river. Collections here were made after nearly all the summer residents had gone south."

From these notes it will be seen that Mr. Streator collected both on the coast, and also in the interior east of the coast range at Ducks and Ashcroft, two regions differing widely in climate and physical characteristics; the coast, with a rainfall heavier than that of any other part of North America, and a resulting dense forest growth, the interior with a minimum of rainfall and vegetation comparatively desert-like in character.

The following table of the precipitation of rain and melted snow compiled from Schott's memoir and data kindly furnished me by Mr. W. A. Stewart, Acting Director of the Meteorological Service of Canada, will serve to illustrate how great are the climatic differences which separate these two regions.

In view of our lack of exact information on the bird-life of this part of North America, an attempt to analyze the relationships of these two regions can be considered little more than preliminary. So far as published records go Mr. Streator collected in an almost new field, and while, as his collections show, his efforts were remarkably successful, they represent the work of but one individual over an extended area during a single season. I know of no reliable faunal lists of the birds of this region with which to compare some apparent anomalies in distribution made evident by his labors. Before dwelling on the influence which the coast climate has on the avi-fauna of the region, I may first briefly outline the territory which this climate affects. In Oregon, Washington, British Columbia and Alaska, this may be done with some approach to accuracy.

TABLE GIVING MEAN AMOUNT, IN INCHES, OF PRECIPITATION IN RAIN AND MELTED SNOW FOR EACH SEASON AND THE YEAR.

| | Lat. | Long. | Height. | Spring. | Summer. | Autumn. | Winter. | Year. |
|---|---|---|---|---|---|---|---|---|
| San Francisco, Cal | 37° 48′ | 122° 25′ | 130 | 5.03 | 0.22 | 3.05 | 13.19 | 21.49 |
| Camp Wright, Cal | 39° 48′ | 123° 17′ | .... | 8.26 | 0.27 | 8.17 | 27.27 | 43.97 |
| Fort Humboldt, Cal | 40° 45′ | 124° 10′ | 50 | 9.36 | 0.73 | 6.49 | 19.33 | 35.91 |
| Astoria, Oregon | 46° 11′ | 123° 48′ | 52 | 18.90 | 5.72 | 18.19 | 34.80 | 77.61 |
| Cape Disappointment, Wash | 46° 17′ | 124° 03′ | 30 | 14.97 | 5.97 | 20.46 | 29.84 | 71.24 |
| New Westminster, B. C | 49° 12′ | 122° 53′ | 33 | 13.09 | 2.04 | 5.58 | 27.00 | 62.96 |
| Port Simpson, B. C | 54° 30′ | 129° 20′ | 16 | 20.74 | 15.52 | 41.01 | 26.95 | 104.22 |
| Sitka, Alaska | 57° 03′ | 135° 20′ | 20 | 15.37 | 14.56 | 30.28 | 21.38 | 81.59 |
| Spence's Bridge, B. C | 50° 25′ | 121° 30′ | 770 | 2.11 | 2.06 | 1.51 | 2.16 | 7.84 |
| Clinton, B. C | 51° 6′ | 122° 48′ | 2978 | .80 | 1.57 | .89 | 2.76 | 6.02 |
| Soda Creek, B. C | 52° 20′ | 122° 19′ | 2225 | 1.14 | 2.85 | 1.44 | 2.26 | 7.69 |

Having for a western boundary the coast line with its outlying islands, the eastern boundary is almost as clearly determined by the mountains of the Coast and Cascade ranges. Here the summits intercepting the moisture-laden winds which arise from the warm currents of the Pacific cause the heavy precipitation, consequent higher temperature, and dense forest growth which characterize this region.

The northern boundary, as defined by Mr. Nelson is his admirable "Report on Natural History Collections made in Alaska," reaches to and includes the island of Kadiak. To quote from this work: "From the west comes the warm water of the northern border of the Japanese current, which flowing about Kadiak Island, bathes the coast thence east and south" (l. c., p. 24).

In the present condition of our knowledge the southern limits of this region can be determined with but slight approximation. The abrupt lines which restrict the climatal conditions of the northern, eastern and western boundaries are wanting on the southern boundary, and we have here a more gradual transition from the coast area of heavy rainfall southward into southern California. It is very probable, however, that a comparison of series of breeding specimens from the true northwest coast region and this southern California extension, will show that while the differences in coloration exhibited may not in every case be worthy of recognition in nomenclature, the birds from the more northern region of heavier rainfall will average darker than those from the south.

On the California coast the southern limits of the northwest coast fauna may probably be drawn in the vicinity of Cape Mendocino, in Humboldt County, at about latitude 40° 30′, or near the annual iso-hyetal line of 38 in. In the interior of the State the annual iso-hyetal line of 20 in. may more or less closely coincide with the breeding ranges of those "coast forms" which occur in California. For the present, at least, it will be useless to attempt to draw this line more closely. Full series of breeding birds, labeled with the altitude at which they were collected, are needed for comparison with more northern specimens before their relationships can be thoroughly understood. To

return, however, to British Columbia where faunal lines are not so complicated, and to the effects of the climate there existing on the avi-fauna of the region.

Climatal influence is here exerted in two ways. First, in differentiation; second, in extension or restriction of habitat.

Of the thirty-one birds which may be enumerated as "northwest coast forms" all have been differentiated from their congeners, and show the effects of this moist, humid climate in much the same manner, and without exception these forms are darker, more richly colored, or more heavily barred or streaked, than any other representative of their respective genera. In producing this result heavy rainfall and humidity are primary factors, but the more immediate agents are the dense vegetation and clouded skies of a moist region which afford protection from the "bleaching" rays of the sun. In every instance these coast forms are represented in contiguous regions by more or less closely-related allies. While several bear full specific titles, their rank is due rather to the failure of zoölogical nomenclature to properly express their relationships than to any valid claim of specific distinctness. Two alone have been sufficiently differentiated to be recognized as species, *Perisoreus obscurus* and *Parus rufescens*.

The following table of coast forms with their interior representatives will show how extended has been the influence of the coast climate, and at the same time exhibit their relationships:

| *Species and Subspecies of the Northwest Coast Fauna.* | *Represented East of the Coast Range by* |
|---|---|
| Dendragapus obscurus fuliginosus | Dendragapus o. richardsoni.<br>Dendragapus franklini. |
| Bonasa umbellus sabini | Bonasa u. togata.<br>Bonasa u. umbelloides. |
| Accipiter atricapillus striatulus | Accipiter atricapillus. |
| Falco peregrinus pealei | Falco p. anatum. |
| Falco columbarius suckleyi | Falco columbarius. |
| Megascops asio kennicotti | Megascops asio subsp. |
| Bubo virginianus saturatus | Bubo v. subarcticus. |
| Dryobates villosus harrisi | Dryobates v. hyloscopus.<br>Dryobates v. leucomelas. |
| Dryobates pubescens gairdneri | Dryobates p. oreœcus.<br>Dryobates pubescens. |
| Colaptes cafer saturatior | Colaptes cafer. |
| Otocoris alpestris strigata | Otocoris a. leucolæma.<br>Otocoris a. merrilli. |
| Cyanocitta stelleri | Cyanocitta s. annectens. |

| | |
|---|---|
| Perisoreus canadensis fumifrons | Perisoreus canadensis. |
| Perisoreus obscurus* | Perisoreus c. capitalis. |
| Carpodacus purpureus californicus | Carpodacus purpureus? |
| Ammodramus sandwichensis | Ammodramus a. alaudinus?† |
| Junco hyemalis oregonus | Junco h. shufeldti. |
| Melospiza fasciata rufina | Melospiza, subsp.? |
| Melospiza fasciata guttata | Melospiza f. guttata. |
| Passerella iliaca unalaschensis | Passerella iliaca.<br>Passerella, subsp.? |
| Pipilo maculatus oregonus | Pipilo m. megalonyx. |
| Helminthophila celata lutescens | Helminthophila celata. |
| Sylvania pusilla pileolata | Sylvania pusilla. |
| Troglodytes hyemalis pacificus | Troglodytes hyemalis? |
| Certhia familiaris occidentalis | Certhia f. montana. |
| Parus atricapillus occidentalis | Parus a. septentrionalis. |
| Parus rufescens | Parus hudsonicus. |
| Psaltriparus minimus | —— —— |
| Regulus satrapa olivaceus | Regulus satrapa. |
| Turdus ustulatus | Turdus u. swainsoni. |
| Turdus aonalaschkæ | Turdus a. auduboni. |

We may now consider the effect of the coast climate on the distribution of species. As before remarked, this is exhibited in two ways, extension and restriction of habitat. Extension of habitat is perhaps most markedly shown by the intrusion of Californian species which range some distance up the coast, but do not occur and have no representative in the interior. *Sphyrapicus ruber*, *Glaucidium gnoma californicus*, and *Psaltriparus minimus* are excellent examples of this class, and perhaps *Coccyzus americanus*, *Habia melanocephala*, *Dendroica nigrescens*, and *D. townsendi* may also be included.

Extension of habitat is also shown by species which, having a representative, or occurring in both regions, are found farther north on the coast than they are in the interior. *Buteo borealis calurus*,‡ *Megascops asio kennicotti*, *Trochilus rufus*,‡ *Empidonax difficilis*,‡ *Corvus caurinus*,‡ and *Melospiza fasciata rufina* perhaps constitute most, if not all, the birds of this class.

Restriction of habitat is apparently caused solely by the character of the vegetation. The coast does not offer a suitable environment for some species which are found in corresponding latitudes of the interior. Thus such plain or prairie loving birds

* Mr. Streator's collection contains no specimens of this genus. The Sitkan form is given by Nelson as *Perisoreus canadensis fumifrons*, which, according to the same author, with *P. canadensis*, is also found in the interior of Alaska.

† Our knowledge of the distribution and forms of the Savanna Sparrow is too incomplete to make this arrangement more than provisional.

‡ *Cf.* Nelson, Report on Natural History Collections made in Alaska, p. 26.

as *Pediocætes phasianellus*, *P. p. columbianus*, *Poocætes gramineus*, and *Spizella socialis arizonæ*, have no place in the heavily-wooded coast. Nor do we find there *Salpinctes obsoletus* which occurs in the cactus regions of the interior.

Mr. Streator's collections from the interior develop two interesting facts. First, a reappearance here west of the Rockies of the eastern type; second, a westward extension in the range of certain eastern species.

Those species, which in the western United States exhibit the "bleaching" effects of a dry and arid region, and are thus differentiated from their eastern allies, in several instances appear in British Columbia in a plumage which more nearly, if not exactly, resembles that of the eastern form.

Thus the *Chordeiles* is *virginianus*, not *C. v. henryi;* the *Poocætes* is *gramineus*, not *P. g. confinis;* while the *Spizella* shows this reappearance to be due to change in climatal conditions rather than a westward migration, by being intermediate between *socialis* and *arizonæ*.

The eastern species, which occur in British Columbia, but do not apparently breed west of the Rockies in the United States, may reach this region by journeying westward along the northern border of the great plains. Mr. Streator found *Tyrannus tyrannus*, *Vireo olivaceus*, and *Galeoscoptes carolinensis*, common in the interior, while the first and last were met with on the coast.

With these introductory remarks we may pass to a detailed consideration of the species contained in the collection. In every instance specimens have been received unless a statement is made to the contrary, when the record is given on the authority of Mr. Streator. Mr. Streator's field notes are given in quotation marks.

**1. Æchmophorus occidentalis.** WESTERN GREBE.—"This species was frequently seen during the summer months about the mountain lakes of the interior, where it doubtless breeds."

No specimens received.

**2. Colymbus holbœlli.** HOLBŒLL'S GREBE.—"One specimen was taken at the mouth of the Columbia, November 3, 1889."

**3. Urinator imber.** LOON.—"Observed under the same circumstances as *Æchmophorus occidentalis*."

No specimens received.

**4. Brachyramphus marmoratus.** MARBLED MURRELET.—"A male was found dead on the beach at Ilwaco, November 8, 1889, after a storm."

**5. Larus glaucescens.** GLAUCOUS-WINGED GULL.—"Abundant at Ilwaco."

**6. Larus occidentalis.** WESTERN GULL.—"Not very common at Ilwaco."

**7. Larus californicus.** CALIFORNIA GULL.—"Rather common at Ilwaco.

**8. Larus brachyrhynchus.** SHORT BILLED GULL.—"Common at Ilwaco."

**9. Larus heermanni.** HEERMAN'S GULL.—"Common at Ilwaco only once, after a heavy storm."

**10. Larus philadelphia.** BONAPARTE'S GULL.—"Very common at Ilwaco."

**11. Fulmarus glacialis glupischa.** PACIFIC FULMAR.—"Large numbers of this species were found dead on the beach at Ilwaco after a heavy storm."

Five specimens without sex mark, four in dark or sooty, and one in white plumage, collected at Ilwaco from October 30 to November 10, are considerably smaller than five specimens collected by Dr. Stejneger at Copper and Bering Islands, the comparative measurements being as follows:

Copper Island specimens,* wing, 12.73; tail, 4.87; tarsus, 1.96; culmen, 1.41.
Ilwaco specimens, wing, 10.58; tail, 4.30; tarsus, 1.79; culmen, 1.37.

**12. Phalacrocorax pelagicus robustus.** VIOLET-GREEN CORMORANT.—"Common at Ilwaco."

One specimen received.

**13. Pelecanus californicus.** CALIFORNIA BROWN PELICAN.—"A few small flocks were seen at Ilwaco."

No specimens received.

**14. Lophodytes cucullatus.** HOODED MERGANSER.—"Generally common."

**15. Anas boschas.** MALLARD.—"Breeds in suitable localities throughout the Province; probably more numerous in the interior."

* Orn. Explor. in Commander Islands. Bull. 29, U. S. Nat. Mus., 1885, p. 94.

**16. Anas carolinensis.** GREEN-WINGED TEAL.—"Observed only in the autumnal migration, when they were common."

**17. Aix sponsa.** WOOD DUCK.—"Common in the coast region. Breeds."

Two immature specimens received.

**18. Aythya americana.** RED-HEAD.—"A single pair observed in July near Ashcroft on a small lake."

No specimens received.

**19. Charitonetta albeola.** BUFFLE-HEAD.—"A few were seen in nearly all the localities visited."

**20. Oidemia perspicillata.** SURF SCOTER.—"Common about Burrard's Inlet during the latter part of April. Abundant at Ilwaco."

**21. Anser albifrons gambeli.** AMERICAN WHITE-FRONTED GOOSE.—"One specimen was shot from a flock of thirty or more at Duncan's on Vancouver."

**22. Olor columbianus.** WHISTLING SWAN.—A male was taken at Ilwaco, November 11.

**23. Botaurus lentiginosus.** AMERICAN BITTERN.—"One specimen was brought me while east of the Coast Range, and several were seen near the mouth of the Frazer River."

No specimens received.

**24. Ardea herodias.** GREAT BLUE HERON.—"Rather common about the lakes and rivers. A settler informed me that two years before he was at a logging camp about ten miles from Mt. Lehman, and found a large number of this species nesting in the locality. In May I visited this place, and although I found no Herons, the large number of nests in the surrounding tree tops gave unmistakable evidence of their former abundance."

No specimens received.

**25. Grus canadensis.** LITTLE BROWN CRANE.—"One specimen, collected at Kalama."

**26. Porzana carolina.** SORA.—"Rather common east of the mountains; chicks were seen running about during the month of July."

**27. Crymophilus fulicarius.** RED PHALAROPE.—"A specimen was taken at Ilwaco, November 9, 1889."

**28. Gallinago delicata.** WILSON'S SNIPE.—"Common during the summer about the mountain lakes and streams east of the Coast Range, where it probably breeds."

**29. Macrorhamphus scolopaceus.** LONG-BILLED DOWITCHER.—"A female taken at Mt. Lehman, September 17, 1889."

**30. Tringa minutilla.** LEAST SANDPIPER.—"Common in the interior during the autumnal migrations."

**31. Tringa alpina pacifica.** RED-BACKED SANDPIPER.—"Very abundant at Ilwaco."

**32. Ereunetes pusillus.** SEMIPALMATED SANDPIPER.—A male taken at Ducks, August 18, measures as follows: No. 47,259, wing, 3.55; tarsus, .83; culmen, .73 in.

**33. Ereunetes occidentalis.** WESTERN SANDPIPER.—A male taken at Ducks, August 22, measures as follows: No. 47,258, wing, 3.65; tarsus, .89; culmen, .83 in. While these measurements are slightly below the limit assigned to this species, the breeding plumage still worn by this specimen permits its identification with the western form.

**34. Totanus flavipes.** YELLOW-LEGS.—"Probably not uncommon in the interior; a specimen was collected and others seen near Ducks."

**35. Totanus solitarius cinnamomeus.** CINNAMON SOLITARY SANDPIPER.

*Totanus solitarius cinnamomeus* BREWSTER, Auk, VII, Oct., 1890.

"Summer resident in the interior. At Ducks I saw individuals that were not able to fly well, and must have been hatched in the vicinity."

No. 47,262, a male taken August 15, one of two specimens received from Ducks, agrees in coloration with an example of *cinnamomeus* from Lower California, loaned me for comparison by Mr. Brewster, but is slightly smaller and lacks the grayish mottling of the inner web of the first primary. This, however, is very probably

a more or less variable character; I find it excellently shown by a typical specimen of *solitarius* from Long Island.

No. 47,261, a female taken August 9, is intermediate between *solitarius* and *cinnamomeus*, but more closely approaches *solitarius* with which it agrees in size. The inner web of the first primary is without grayish mottling, but the light spots of the upper surface, while not so brown as in typical *cinnamomeus*, are browner than in *solitarius*.

**36. Actitis macularia.** SPOTTED SANDPIPER.—"Summer resident in the interior."

**37. Ægialitis vocifera.** KILDEER.—"The cry of this species was heard a number of times during the summer months in the interior."

No specimens received.

**38. Oreortyx pictus.** MOUNTAIN PARTRIDGE.—"A flock of about twenty birds was seen at Kalama."

No specimens received.

**39. Dendragapus obscurus fuliginosus.** SOOTY GROUSE.—"On my arrival on the coast in the month of April, the calls of the males of this species could be heard nearly throughout the day. They were almost invariably found in the highest tree tops where it was very difficult to locate, and still more difficult to shoot them. On Vancouver Island they are said to breed in the valleys, but in September return to the mountains. They are much sought for by gunners."

**40. Dendragapus obscurus richardsonii.** RICHARDSON'S GROUSE.—"This species was found abundant in the interior, where it appears to take the place of the preceding. They remain in the mountains except in the breeding season, when they descend to the valleys. At this time they become so tame they may be killed with sticks or stones."

The collection contains only six adult females taken from June 28 to July 7, and three nearly half-grown young taken July 12 and 13. In the adult specimens the tail has an indistinct but appreciable grayish terminal band.

**41. Bonasa umbellus togata.** CANADIAN RUFFED GROUSE. —"Common in the interior. Found about thickets which border running water."

Four specimens agree with examples from New Brunswick loaned me for comparison by Mr. J. Dwight, Jr. They are also similar to a specimen in the American Museum collected at Fort Klamath by Capt. Bendire. Half-grown young were taken at Ducks, July 18 and August 9.

**41** *bis.* **Bonasa umbellus sabini.** OREGON RUFFED GROUSE. —"One of the most abundant birds of the coast region. On Vancouver Island it is common and generally distributed."

One of three adult specimens from Mt. Lehman, taken June 6, is clearly intermediate between this form and the preceding. A nearly half-grown young bird, taken at Mt. Lehman, June 16, is indistinguishable from *togata* in nearly the same stage of plumage.

**42. Pediocætes phasianellus columbianus.** COLUMBIAN SHARP-TAILED GROUSE.—"Common in some places in the interior, but said by residents to be rapidly diminishing in numbers. They remain about the cultivated districts throughout the year."

**43. Columba fasciata.** BAND-TAILED PIGEON.—"A very common summer resident on the coast district. They commence to arrive in the latter part of April, and remain for some time in flocks before nesting. They are a source of great annoyance to the settlers, especially at the time of their arrival. Flocks of several hundred were seen at times sitting on trees watching the farmer sow his oats, and upon his leaving the spot they would invariably take possession. On Vancouver Island a single one was seen, and at Kalama one bird was found."

**44. Zenaidura macroura.** MOURNING DOVE.—"Not uncommon in the interior. None were seen on the coast."

**45. Cathartes aura.** TURKEY VULTURE.—"A few were met with."

No specimens received.

**46. Circus hudsonius.** MARSH HAWK.—"Common on the coast and abundant in the interior."

The three specimens received are from Ducks.

**47. Accipiter velox.** SHARP-SHINNED HAWK.—"Common everywhere. Abundant during the migrations."

Four specimens received from Ducks, and one from Westminster.

**48. Accipiter cooperi.** COOPER'S HAWK.—"Met with only at Ducks. Rare."

**49. Accipiter atricapillus.** AMERICAN GOSHAWK.—"Rather common; more numerous in the interior than on the coast."

Two immature specimens from Ducks are referable to this species. The coast bird which Mr. Streator mentions, but of which he sent no specimens, is probably *A. a. striatulus.*

**50. Buteo borealis calurus.** WESTERN RED-TAIL.—"Rare. One specimen was brought me at Ducks, and two or three others seen."

No specimens received.

**51. Aquila chrysaëtos.** GOLDEN EAGLE.—"Rare. A few specimens seen about the higher mountains near Ducks. I examined a freshly-skinned specimen said to have been shot within fifty miles of Ducks."

No specimens received.

**52. Haliæetus leucocephalus.** BALD EAGLE.—"Very common about the rivers, especially during August, when many dead salmon may be seen drifting. Common on Vancouver Island and at Kalama."

No specimens received.

**53. Falco peregrinus anatum.** DUCK HAWK.—"One specimen was sent me for identification from the interior, and a few others were seen."

No specimens received.

**54. Falco columbarius.** PIGEON HAWK.—"One specimen taken on Vancouver Island, and probably a few others seen."

**55. Falco sparverius.** AMERICAN SPARROW HAWK.—"Rare on the coast, but very abundant in the interior."

Six adult females from Ducks appear to be very heavily marked below.

**56. Pandion haliaëtus carolinensis.** AMERICAN OSPREY.—"Very common."

**57. Asio accipitrinus.** SHORT-EARED OWL.—"Found only on the coast. A male, taken at Westminster, May 14, at mid-day, was flying a few feet above the ground apparently looking for field mice. Remains of two mice were found in the stomach."

**58. Bubo virginianus subarcticus.** WESTERN HORNED OWL.—"Common. Young birds were taken at Ashcroft, June 20."

**59. Nyctea nyctea.** SNOWY OWL.—"A rather remarkable migration of this species occurred at the mouth of the Columbia River. Ten specimens were taken during my stay, and Dr. T. H. Parks, of Ilwaco, writes me that he killed six more soon after I left. The birds were always found sitting on the drift wood along the ocean beach, and were very tame."

**60. Glaucidium gnoma californicum.** CALIFORNIA PIGMY OWL.—"Common in the coast region. Very common during the migration. A nest found at Mt. Lehman about the middle of May was placed in a Woodpecker's deserted hole about ten feet from the ground. It contained one egg which had been broken by school boys the day before my arrival."

Three specimens from Mt. Lehman prove, on comparison with examples loaned me by Mr. Ridgway, to be typical of this race."

**61. Coccyzus americanus.** YELLOW-BILLED CUCKOO.—"While being transferred across the Frazer River at Mt. Lehman we passed near an island where I heard the unmistakable notes of a Cuckoo. I at once directed the boat to the spot; the bird was seen, and I feel positive it was the above species.

"Mr. Fannin, of the Provincial Museum at Victoria, informed me that this species has been taken in British Columbia, and I therefore consider it safe to give this record."

No specimens received.

**62. Ceryle alcyon.** BELTED KINGFISHER.—"Found abundant everywhere, probably on account of its having an endless food supply."

**63. Dryobates villosus leucomelas.** NORTHERN HAIRY WOODPECKER.—"Common throughout the interior. Breeds."

Two males from Ashcroft measure as follows: No. 47,337, June 24; wing, 5.40; tail, 3.60; culmen, 1.30. No. 47,338, July 3; wing, 5.20; tail, 3.35; culmen, 1.35. No. 47,337 is fairly typical of *leucomelas*, and has the greater and lesser wing-coverts and tertiaries spotted with white. No. 47,338 shows an evident approach towards *hyloscopus;* there are few white markings on either wing-coverts or tertiaries. It is probable that these two forms intergrade in this region.

**64. Dryobates villosus harrisi.** HARRIS'S WOODPECKER.—"Abundant everywhere throughout the coast region. Breeds."

Examination of twenty-two specimens of this species collected on the coast by Mr. Streator shows that the diagnostic character of unspotted wing-coverts cannot be depended upon. In only three specimens of this series are the lesser coverts absolutely without spots, while the amount of variation shown by the lot ranges from this condition to a degree of spottedness not differing from *villosus.* Without reference to these parts, however, *harrisi* may always be distinguished from either *D. villosus*, *leucomelas*, or *hyloscopus* by the sooty suffusion of the white parts of the plumage. While this coloration may originally have been acquired through contact with the moist and lichen-covered tree trunks of a humid region, there can be no doubt that it has now become permanent and inherent. This is proved by (1) the adult specimens, which in fresh and unworn plumage exhibit the usual amount of sootiness, and (2) by young birds still wearing the red crown-cap, which have the whitish areas both above and below fully as dark as the average specimen of this series.

Mr. Ridgway has kindly sent me for comparison the Alaskan specimens of this genus contained in the U. S. National Museum. As might be expected, the birds from east of the coast range are referable to *D. v. leucomelas*, but I cannot agree with Mr. Nelson* in referring specimens from the "southeastern coast of Alaska" to *D. villosus.* A male and female in the U. S. National Museum from Sitka, numbers 45,848 and 45,850, very probably the same birds on which Mr. Nelson's record is based, I should refer without hesitation to *D. v. harrisi.* They are characterized by the sooty coloration peculiar to northwest coast specimens, which

* Report on Natural History Collections made in Alaska, p. 155.

is not as intense, however, as in some British Columbia specimens, and while No. 45,848 has the wing-coverts heavily spotted, they are no more so than in an example from Westminster, and in No. 45,850 these markings agree with those of the average British Columbia bird. Further than this, the known distribution of the two forms, *villosus* and *leucomelas*, would not account for the presence of the former on the south Alaskan coast where *harrisi* should naturally be found. Measurements of coast and interior specimens are here appended :

| *Dryobates v. harrisi.* | Sex. | Wing. | Tail. | Exposed Culmen. |
|---|---|---|---|---|
| Kalama, Wash. | ♂ | 5.15 | 3.32 | 1.16 |
| Vancouver Island | ♂ | 5.02 | 3.16 | 1.22 |
| " " | ♀ | 4.94 | 3.28 | 1.14 |
| Westminster, B. C. | ♀ | 4.84 | 3.06 | 1.02 |
| " " | ♂ | 5.06 | 3.00 | 1.20 |
| Mt. Lehman, B. C. | ♂ | 5.10 | 3.10 | 1.25 |
| Sitka, Alaska | ♂ | 4.88 | 3.02 | 1.08 |
| " " | ♀ | 4.92 | 3.30 | 1.01 |
| *Dryobates v. leucomelas.* | | | | |
| Ashcroft, B. C | ♂ | 5.40 | 3.60 | 1.30 |
| Fort Liard | ♂ | 5.30 | 3.44 | 1.40 |
| Fort Reliance, Alaska | ♀ | 5.24 | 3.25 | 1.30 |

**65. Dryobates pubescens gairdneri.** GAIRDNER'S WOODPECKER.—"Rather common throughout the coast region. Breeds."

From Westminster, Mt. Lehman, Vancouver Island and Kalama, Mr. Streator sends in all twelve birds. They agree among themselves, and show uniformly the characteristic sooty coloration which also distinguishes the preceding form. While some specimens have more or less white marking on both wing-coverts and tertiaries, these spots are generally more restricted than in the series of *D. v. harrisi* previously mentioned.

In the Alaskan series sent me by Mr. Ridgway, only two specimens are from the Sitkan District, and these from Kadiak Island, its northern limit. Both these specimens are *pubescens.* I cannot, however, consider them as representatives of the Sitkan District where it is probable *gairdneri*, or a close ally, will be found.

**66. Dryobates pubescens oreœcus.** BATCHELDER'S WOODPECKER.—" Very common throughout the interior. Breeds."

Two adults and a young bird, the first in worn, the latter in partially completed plumage, received from Ducks and Ashcroft.

After comparison with specimens of *oreœcus* loaned me by Mr. Batchelder I provisionally refer these interior birds to that race, but we require more and better material before their relationships can be accurately determined. In the white markings of the wing-coverts and tertiaries they resemble *pubescens*, but the under tail-coverts are apparently without black markings, and are similar, therefore, to those of *oreœcus*. The birds are thus evidently intermediate between the two.

**67. Picoides arcticus.** ARCTIC THREE-TOED WOODPECKER. —"Common at Ducks in August, when they were on their southern migration."

**68. Sphyrapicus varius nuchalis.** RED-NAPED SAPSUCKER. —"Found common everywhere in the interior. Breeds."

**69. Sphyrapicus ruber.** RED-BREASTED SAPSUCKER.—"Found only on the coast. Rare. One pair was collected at Westminster, May 19, and a few others seen."

**70. Ceophlœus pileatus.** PILEATED WOODPECKER.—"Common in the coast region, where it breeds. On Vancouver Island they were not very common."

Seven specimens from Westminster, Mt. Lehman and Vancouver Island, agree exactly in coloration with Florida examples. In size there is a remarkably slight variation, the average measurements of seven specimens from each region being as follows:

Streator specimens, wing, 9.16; tail, 6.37; exposed culmen, 1.97.
Florida specimens, wing, 8.70; tail, 6.06; exposed culmen, 1.76.

**71. Melanerpes torquatus.** LEWIS'S WOODPECKER.—"Abundant in the interior. Breeds."

**72. Colaptes cafer.** RED-SHAFTED FLICKER.—Five specimens received from Ashcroft. No. 47,412, a bird of the year taken June 22, has wings and tail similar to those of *C. auratus*, while the head and neck agree in coloration with *cafer*.

**73. Colaptes cafer saturatior.** NORTHWESTERN FLICKER.—"Abundant on the coast."

In a series of sixteen specimens, a female taken at Westminster, May 8, has three other tail feathers on one side as in *C. auratus*.

**74. Chordeiles virginianus.** NIGHTHAWK.—"Abundant summer resident in the interior. Breeds."

Eight adult specimens from Ashcroft agree in coloration with average eastern examples of *virginianus*.

**75. Trochilus rufus.** RUFOUS HUMMING BIRD.—"Moderately common everywhere."

Specimens received from Ducks (July 20), Mt. Lehman (June 20), and Westminster (April 21, May 1 and 11).

**76. Tyrannus tyrannus.** KINGBIRD.—"Abundant in the interior and decreasing in numbers towards the coast. First arrivals were noted about June 5. Breeds."

Specimens from Ducks and Mt. Lehman are indistinguishable from eastern examples. Comparative average measurements of four British Columbia and the same number of eastern specimens are as follows :

British Columbia, wing, 4.73 ; tail, 3.34 ; exposed culmen, .65.
Atlantic States, wing, 4.73 ; tail, 3.42 ; exposed culmen, .67.

**77. Tyrannus verticalis.** ARKANSAS KINGBIRD.—"Not common on the coast. At Ashcroft it was more abundant than *T. tyrannus ;* at Ducks it was less abundant than that species."

Nine specimens from Ashcroft agree in size and coloration with examples from Pinal County, Arizona. The average measurements of five males and five females from each locality are as follows :

Pinal Co., Arizona, males, wing, 5.14 ; tail, 3.54 ; exposed culmen, .81.
Ashcroft, B. C., males, wing, 5.10 ; tail, 3.68 ; exposed culmen, .77.
Pinal Co., Arizona, females, wing, 4.87 ; tail, 3.37 ; exposed culmen, .78.
Ashcroft, B. C., females, wing, 4.77 ; tail, 3.38 ; exposed culmen, .74.

**78. Sayornis saya.** SAY'S PHŒBE.—"Common in the interior. Abundant during the migrations."

**79. Contopus borealis.** OLIVE-SIDED FLYCATCHER.—"A not uncommon and generally distributed summer resident. They commenced to arrive about May 1, and for a time were very shy. They were nearly always found perched on the topmost point of a dead tree where they would sit calling for half an hour. Under favorable circumstances I have heard them quite plainly when half a mile distant."

Specimens received from Ducks and Westminster.

**80. Contopus richardsoni.** WESTERN WOOD PEWEE.—"Not common on the coast, but abundant in the interior. Breeds."

**81. Empidonax difficilis.** WESTERN FLYCATCHER.—"Common in the coast region, and more so in the interior. Breeds."

**82. Empidonax pusillus trailli.** TRAILL'S FLYCATCHER.—"Much more common in the interior than on the coast. Breeds."

Five specimens from Mt. Lehman, New Westminster and Ashcroft I am forced to refer to the eastern form. Two of them, one from Mt. Lehman and one from Ashcroft, are darker than specimens from Carlisle, Pa., and Hoboken, N. J., with which the remaining three British Columbia specimens agree.

**83. Empidonax hammondi.** HAMMOND'S FLYCATCHER.—"Rather common. Breeds."

Specimens received from Ashcroft, Ducks, Mt. Lehman and Westminster.

**84. Otocoris alpestris merrilli.** DUSKY HORNED LARK.—"Observed only in the interior, at favorable localities. A number of pairs were found on a grass-covered mountain about two thousand feet above Ashcroft in the month of July, and were doubtless breeding."

**85. Pica pica hudsonica.** AMERICAN MAGPIE.—"Found common everywhere. Breeds about Ashcroft."

**86. Cyanocitta stelleri.** STELLER'S JAY.—"Abundant resident throughout the Province. These birds are very destructive to garden vegetables, especially potatoes, which they dig up, eat, and destroy at every opportunity. Their habits cause them to be disliked by the residents, who shoot them whenever they can. On Vancouver Island they are abundant."

A young bird in first plumage, taken at Mt. Lehman, June 18, has the wings and tail fully grown, and resembles the adult in coloration, but lacks the blue frontal streaks.

For remarks on the Vancouver Island specimens ("*Cyanocitta litoralis*" Mayn.) see the Auk, III, 1890, p. 91.

**87. Cyanocitta stelleri annectens.** BLACK-HEADED JAY.—"This species was met with only high up in the mountains near Ducks. In August they were more common as they were then on their southward migration."

Six specimens taken in August at Ducks, the only ones received from the interior, I refer to this form. The plumage lacks the bluish cast seen in the coast specimens, and in each at least a trace of the whitish supra-ocular spot may be observed.

**88. Corvus americanus.** AMERICAN CROW.

**89. Corvus caurinus.** NORTHWEST CROW.—Whatever distinguishing characters are possessed by the sixteen Crows Mr. Streator collected are fully shown by the appended table of measurements. Coloration is apparently of no diagnostic value—examples which measurements proclaim *caurinus* are as glossy as any of the larger birds, while some of these are as lustreless as any bird in the series. Mr. Streator's notes are of little assistance. He found Crows breeding at Mt. Lehman and at Ashcroft, and says the nests were "commonly placed in small shrubs and bushes within hand's reach from the ground." On inquiry he further says, the voices of the coast and interior Crows differ very much from each other, the former resembling more that of the Raven, but he does not remember whether any differences existed in the construction of the nest.

There is, of course, no doubt that *caurinus* has an equal claim with *ossifragus* to specific rank. Nevertheless the fact remains that however distinct they may be in life, in this series of sixteen dried skins, the extremes of which may be respectively called *caurinus* and *americanus*, no constant character can be found which will permit the identification of every specimen with certainty.

| | Sex. | Wing. | Tail. | Tarsus. | Exposed Culmen. |
|---|---|---|---|---|---|
| Ashcroft, B. C. | | 11.12 | 7.05 | 2.15 | 1.56 |
| " " | | 11.75 | 7.00 | 2.35 | 1.75 |
| " " | ♀ | 11.95 | 6.75 | 2.12 | 1.68 |
| Westminster, B. C. | ♂ | 10.90 | 6.12 | 1.80 | 1.76 |
| " " | ♂ | 10.40 | 6.62 | 2.01 | |
| " " | ♂ | 11.00 | 6.60 | 1.85 | 1.60 |
| Mt. Lehman, B. C | ♀ | 11.00 | 6.80 | 2.00 | 1.62 |
| Vancouver Island | ♀ | 11.20 | 6.50 | 1.90 | 1.62 |
| " " | ♂ | 11.15 | 6.60 | 1.94 | 1.70 |
| " " | ♀ | 10.50 | 5.90 | 1.89 | 1.55 |
| " " | ♂ | 11.40 | 6.30 | 2.00 | 1.68 |
| " " | | 11.40 | 6.50 | 1.96 | 1.68 |
| " " | ♂ | 9.75 | 5.30 | 1.89 | 1.46 |
| Cape Disappointment, Wash. | | 11.50 | 6.60 | 1.80 | 1.63 |
| Kalama, Wash. | ♂ | 12.05 | 6.75 | 2.16 | 1.80 |

**90. Picicorvus columbianus.** CLARKE'S NUTCRACKER.—"Abundant summer residents throughout the coniferous forests of the interior. During my acquaintance with them, from about June 15 to September 1, they were invariably associated in flocks."

**91. Sturnella magna neglecta.** WESTERN MEADOW LARK.—"Common on the coast where there are meadows. Very abundant in the interior. Wherever I collected I was voluntarily informed by the older white settlers, that this species had appeared only in the last few years. On Vancouver Island it was numerous about cleared land."

Specimens from the interior agree with those from the coast, and both are typical of *neglecta*.

**92. Icterus bullocki.** BULLOCK'S ORIOLE.—"I met with this bird only at Ashcroft, where one specimen was taken and a few more seen. I think this is about the northern limit of this bird's range."

**93. Scolecophagus cyanocephalus.** BREWER'S BLACKBIRD.—"Generally distributed, but not common."

**94. Coccothraustes vespertina montana.** "Met with in the interior only. In August they were passing southward in flocks of considerable size."

**95. Carpodacus purpureus californicus.** CALIFORNIA PURPLE FINCH.—"Common in the coast region. Few specimens were taken in purple plumage."

**96. Loxia curvirostra minor.** AMERICAN CROSSBILL.—"From July 16 to September, pairs were seen commonly about Ducks, flying from tree to tree, looking for food. Later, a few flocks were seen on the coast flying southward."

A female taken at Ducks, August 8, is in the streaked plumage of the young bird.

**97. Spinus pinus.** PINE SISKIN.—"Extremely abundant; arriving and departing in enormous flocks."

**98. Poocætes gramineus.** VESPER SPARROW.—"Very common in the interior. Breeds."

Seven examples from Ashcroft are slightly larger, but otherwise apparently indistinguishable from the eastern bird. The com-

parative measurements of six Ashcroft specimens, with an equal number from the vicinity of New York, are as follows:

Ashcroft specimens, wing, 3.30; tail, 2.48; exposed culmen, .42.
Eastern specimens, wing, 3.24; tail, 2.40; exposed culmen, .41.

**99. Ammodramus sandwichensis.** SANDWICH SPARROW.—"Common on the coast in the fall."

Mr. Streator's series, consisting of twenty-nine specimens, taken on the coast from April 12 to October 26, contains, as might be expected, examples ranging in size from the smaller resident *alaudinus*, which may winter in reduced numbers, to the larger *sandwichensis*, which comes down from the north at this season. A comparison of the following measurements with those given under the next species will illustrate how completely these two forms intergrade.

MEASUREMENTS OF FALL SPECIMENS OF *Ammodramus*,

ARRANGED ACCORDING TO SIZE.

| Date. | Sex. | Wing. | Tail. | Exposed Culmen. |
|---|---|---|---|---|
| October 1, 1889 | ♀ | 2.62 | 1.94 | .40 |
| " 2, " | ♀ | 2.80 | 1.94 | .42 |
| " 2, " | ♀ | 2.80 | 2.05 | .44 |
| " 17, " | | 2.80 | 1.96 | .41 |
| September 22, 1889 | ♀ | 2.82 | 2.00 | .36 |
| October 26, " | ♀ | 2.83 | 2.05 | .42 |
| September 28, " | ♀ | 2.86 | 2.06 | .41 |
| " 28, " | | 2.90 | 2.08 | .44 |
| " 19, " | | 2.91 | 2.08 | .39 |
| October 1, " | ♀ | 2.92 | 2.05 | .43 |
| " 15, " | ♂ | 2.92 | 2.09 | .40 |
| " 26, " | ♀ | 2.92 | 2.12 | .42 |
| " 1, " | ♂ | 2.94 | 2.06 | .42 |
| September 17, " | ♀ | 2.95 | 2.06 | .44 |
| " 17, " | ♀ | 2.95 | 2.12 | .44 |
| October 17, " | ♂ | 2.98 | 2.12 | .42 |
| September 19, " | ♂ | 3.02 | 2.35 | .40 |
| " 17, " | | 3.03 | 2.20 | .45 |

**100. Ammodramus sandwichensis alaudinus.** WESTERN SAVANNA SPARROW.—"Abundant summer resident on the coast."

Mr. Ridgway, to whom I have sent specimens of this bird for comparison, writes me that he considers them typical of *alaudinus*, and that they agree very closely both in size and coloration with breeding specimens from Nevada and Utah.

A specimen taken at Ducks, September 3, may also be referred to this form. The average measurements of nine specimens taken at Westminster and Mt. Lehman during May and June, and also, for comparison, two Alaskan specimens of true *sandwichensis*, are as follows :

*Alaudinus*, wing, 2.68 ; tail, 1.85 ; exposed culmen, .40.
*Sandwichensis*, wing, 3.00 ; tail, 2.12 ; exposed culmen, .45.

**101. Zonotrichia leucophrys intermedia.** INTERMEDIATE SPARROW.—" Rare spring and fall migrant."

**102. Zonotrichia coronata.** GOLDEN-CROWNED SPARROW.—" Very abundant spring and fall migrant."

**103. Spizella socialis arizonæ.** WESTERN CHIPPING SPARROW.—" Found only in the interior, where it breeds abundantly."

Specimens from Ashcroft are intermediate between typical *socialis* and *arizonæ*. In color they are nearer *arizonæ*, but are not so pale as Arizona specimens ; in size they are nearer *socialis*, Comparative measurements of four specimens each, of *socialis*. *arizonæ*, and the Ashcroft examples, are given below.

*Socialis*, wing, 2.77 ; tail, 2.27 ; exposed culmen, .35.
Ashcroft, wing, 2.75 ; tail, 2.32 ; exposed culmen, .35.
*Arizonæ*, wing, 2.83 ; tail, 2.42 ; exposed culmen, .35.

**104. Junco hyemalis oregonus.** OREGON JUNCO.—" One of the most common birds in the Province. Found everywhere. Breeds."

Mr. Streator's series of Juncos referable to this form are all from the coast, and consists of six specimens taken on Vancouver Island and at Kalama in October, and eleven specimens taken during April, May, and June at New Westminster and Mt. Lehman. In addition to these, Mr. Ridgway has sent me the U. S. National Museum material, including the two original Townsend specimens taken on the Columbia River, October 5 and 16, 1834. The first of these, No. 1947, is labeled " Type of Fringilla oregona Towns.," and is a somewhat extreme example of the coast bird ; the other, No. 1948, is an average example of the same form, leaving no room for doubt, therefore, as to the applicability of Townsend's name to the Junco inhabiting the northwest coast region.

**105. Junco hyemalis shufeldti.** Rocky Mountain Junco. —The Junco breeding in the plateau region between the coast range and the Rockies and migrating south in winter to Arizona, New Mexico and Northern Texas, is evidently separable from the coast form, and is probably the bird which Mr. H. K. Coale has named *Junco hyemalis shufeldti.** Mr. Coale's type (No. 106,025 U. S. Nat. Mus.), kindly loaned me for examination by Mr. Ridgway, is not typical of this interior bird, indeed is intermediate between it and true *oregonus;* nor does his description clearly define the differences existing between the two birds. It seems more advisable, however, to accept his name for the interior form than to further complicate matters by giving it a new appellation.

In comparing *shufeldti* with *oregonus* the great seasonal changes these birds undergo must be borne in mind, and the specimens should be strictly comparable as regards date of collecting. At the conclusion of the fall moult, the black of the head, neck and throat is more or less obscured by the rusty or ashy edgings of the feathers, which, as the season advances, gradually disappear. In both forms these changes are the same and the differences which separate birds in the same stage of plumage consist in extent of the black markings and intensity of coloration. In fall male specimens of *oregonus* the black of head and neck is slightly deeper and averages of greater extent than in *shufeldti;* the reddish brown of the back is heavier and darker, and extends a little further down the back ; and, as a rule, the two outer rectrices alone are white, this color only appearing occasionally as a more or less well-developed streak on the inner web of the third feather, while in *shufeldti* the opposite occurs, and it is unusual for the third feather to be without at least a streak of white, and at times it is nearly as white as the outer ones. In size *shufeldti* averages larger than *oregonus*, but the difference is too slight to be of diagnostic value. In spring and summer plumage I have an excellent series of fifteen specimens of *oregonus* from the coast, but the specimens of *shufeldti* are in much worn plumage or otherwise in too poor condition to be satisfactory. So far as they go, however,

* Auk, IV, 1889, p. 330.

they indicate that the differences which distinguish the two forms in summer are of the same nature, but somewhat more pronounced than those which separate them in the winter. From Ashcroft Mr. Streator sends three worn adult birds, taken July 13, and a young bird in streaked plumage taken June 24. Mr. Ridgway has loaned me two specimens taken by Mr. R. McFarlane at Stuart's Lake, B. C., one of which, No. 117,010, is labeled by the collector as having been taken with "five eggs."

**106. Melospiza fasciata guttata.** RUSTY SONG SPARROW.—"Common."

These Song Sparrows, unlike the Savanna Sparrows mentioned above, are apparently not migratory, but to some extent, at least, are resident in the coast region. Comparison shows that fall specimens do not appreciably differ in size from those taken during the summer. In the coloration of the upper parts several of the fall examples agree well with *rufina*, but below none are so heavily marked as the Sitkan form, which has the white throat patch confined to the chin and upper throat, whereas in *guttata* this white patch occupies the whole throat and extends to the upper breast.

It is not a little singular that three adults and a bird in first plumage taken at Ashcroft, June 6 to 16, are indistinguishable either in size or coloration from the coast form.

Comparative average measurements of fourteen summer and fifteen fall specimens in the Streator collection, with two Sitkan examples of *rufina*, are as follows :

Summer specimens, wing, 2.66 ; tail, 2.54 ; exposed culmen, .46.
Fall specimens, wing, 2.63 ; tail, 2.57 ; exposed culmen, .46.
*M. f. rufina*, wing, 2.87 ; tail, 2.75 ; exposed culmen, .51.

**107. Melospiza lincolni.** LINCOLN'S SPARROW.—"Common during the autumnal migration."

Mr. Streator sends a series of twelve Lincoln's Sparrows. Six were taken at Ducks, August 29 to September 1 ; four at Mt. Lehman, September 9 to 13, and two on Vancouver Island, October 6 and 7. These birds show considerable variation among themselves, and may be arranged in an almost unbroken series from the lightest-colored specimen to the darkest. Two of the

most heavily-marked examples, one from Mt. Lehman, taken September 13, and one from Vancouver, taken October 6, may be referred to *Melospiza lincolni striata*, a form whose standing is doubtful, but which may prove to be an imperfectly differentiated race, breeding in the coast region.

**108. Passerella iliaca unalaschensis.** TOWNSEND'S SPARROW.—"Not an uncommon spring and fall migrant."

Fall specimens are of a uniform seal-brown color above, and are much darker than those taken in the spring.

No. 47,735, a male taken at Mt. Lehman, September 8, is apparently intermediate between *P. i. schistacea* and the present species. It may represent a new race. The measurements are as follows:

Wing, 3.11; tail, 2.62; exposed culmen, .42; height of bill at nostril, .31 in.

**109. Pipilo maculatus megalonyx.** SPURRED TOWHEE.—An adult male and female received from Ashcroft.

**110. Pipilo maculatus oregonus.** OREGON TOWHEE.—"Abundant on the coast. Breeds."

The young in first plumage differs from the young of *megalonyx*, in about the manner and to the same degree as do the adults from each other. The lighter areas in *oregonus* are darker and more restricted than in *megalonyx*. This is particularly noticable in the white markings of the greater wing-coverts, which in *megalonyx* occupy the terminal third of the outer web of the feather, but in *oregonus* are reduced to a small apical spot.

**111. Habia melanocephala.** BLACK-HEADED GROSBEAK.—"Common summer resident of the coast region. Breeds. Arrived about May 1."

**112. Passerina amœna.** LAZULI BUNTING.—"Abundant summer resident in the interior; less common on the coast. The last specimen seen was on August 26. Breeds."

**113. Piranga ludoviciana.** LOUISIANA TANAGER.—"Abundant summer resident everywhere. On first arriving the males may be found at daybreak singing from the topmost branches of the highest trees, which often reach a height of three hundred feet."

**114. Petrochelidon lunifrons.** CLIFF SWALLOW.—"Common everywhere in the interior. Breeds."

An adult male and female taken at Ashcroft, June 25, agree with western specimens in having the frontal band slightly paler and wider than that of average eastern examples. Comparative average measurements of British Columbia and eastern specimens are as follows :

British Columbia, 2 specimens ; wing, 4.27 ; tail, 1.82 ; exposed culmen, .27.
Eastern, 2 specimens ; wing, 4.24 ; tail, 1.85 ; exposed culmen, .27.

**115. Chelidon erythrogaster.** BARN SWALLOW.—"Common everywhere. Breeds."

**116. Tachycineta bicolor.** TREE SWALLOW.—"Common summer resident in the coast region. Breeds."

Comparative average measurements of British Columbia and eastern specimens are as follows :

British Columbia, 5 specimens ; wing, 4.72 ; tail, 2.15 ; exposed culmen, .25.
Eastern, 5 specimens ; wing, 4.75 ; tail, 2.11 ; exposed culmen, .23.

**117. Tachycineta thalassina.** VIOLET-GREEN SWALLOW.—"Found only at Ashcroft. Breeds."

**118. Stelgidopteryx serripennis.** ROUGH-WINGED SWALLOW.—"Common throughout the Province. Breeds."

Comparative average measurements of eastern and British Columbia specimens are as follows :

British Columbia, 5 specimens ; wing, 4.24 ; tail, 1.91 ; exposed culmen, .26.
Eastern, 5 specimens ; wing, 4.32 ; tail, 1.98 ; exposed culmen, .23.

**119. Ampelis cedrorum.** CEDAR WAX-WING.—"Common wherever there is an abundant food supply. Breeds."

**120. Lanius borealis.** NORTHERN SHRIKE.—"Seen only on Vancouver Island where two immature females were taken September 28."

**121. Vireo olivaceus.** RED-EYED VIREO.—"Common at Ashcroft, and abundant at Ducks. They were found numerous about deciduous trees, which border creeks and lakes."

This species has not apparently before been recorded from west of the Rockies. Six specimens from Ducks and Ashcroft do not differ in coloration from eastern examples.

Comparative average measurements of British Columbia and eastern specimens are as follows :

British Columbia, 7 specimens ; wing, 3.20 ; tail, 2.16 ; exposed culmen, .49.
Eastern, 7 specimens ; wing, 3.15 ; tail, 2.07 ; exposed culmen, .48.

**122. Vireo gilvus.** WARBLING VIREO.—"Very numerous everywhere. Breeds."

Examples from Westminster, Mt. Lehman and Ashcroft agree with specimens from Pinal County, Arizona.

Comparative average measurements of British Columbia and eastern specimens are as follows :

British Columbia, 8 specimens ; wing, 2.45 ; tail, 1.95 ; exposed culmen, .35.
Eastern, 8 specimens ; wing, 2.79 ; tail, 2.08 ; exposed culmen, .40.

**123. Vireo solitarius cassinii.** CASSIN'S VIREO.—"Rare ; only two specimens collected."

One specimen from Ashcroft, July 13, and one from Ducks, August 22.

**124. Helminthophila celata.** ORANGE-CROWNED WARBLER.—Two adults, male and female, and a young male, taken at Ducks, August 31 and September 2, and August 10, respectively. The young bird still shows traces of first plumage.

**125. Helminthophila celata lutescens.** LUTESCENT WARBLER.—Five specimens taken at Westminster, May 5 to 22, and one taken at Mt. Lehman, September 15, are typical of this coast form, and are at once distinguishable from the preceding.

**126. Dendroica æstiva.** YELLOW WARBLER.—"Very common everywhere. Breeds."

Examples from the coast and interior agree with each other, and are indistinguishable from eastern specimens.

Comparative average measurements are as follows :

British Columbia, 8 specimens ; wing, 2.44 ; tail, 1.76 ; exposed culmen, .38.
Atlantic States, 8 specimens ; wing, 2.47 ; tail, 1.73 ; exposed culmen, .38.

**127. Dendroica coronata.** MYRTLE WARBLER.—"Not common, and found only near the coast. On Vancouver Island a few individuals were observed associating with *D. auduboni*."

**128. Dendroica auduboni.** AUDUBON'S WARBLER.—"Abundant spring and fall migrant. I think a few breed in the coast

region, and also on the higher mountains of the interior. On Vancouver Island and at Kalama, it was found very common, migrating southward in large numbers."

**129. Dendroica nigrescens.** BLACK-THROATED GRAY WARBLER.—"Found in the coast region only. Not common."

**130. Dendroica townsendi.** TOWNSEND'S WARBLER.—"A single specimen was collected at Mt. Lehman, September 15, and a few others were seen."

**131. Seiurus noveboracensis notabilis.** GRINNELL'S WATER-THRUSH.—"Two specimens were taken at Ducks, August 7 and 9."

**132. Geothlypis macgillivrayi.** MACGILLIVRAY'S WARBLER. —"Common summer resident. Breeds."

Specimens received from Ducks, Mt. Lehman and Westminster.

**133. Geothlypis trichas occidentalis.** WESTERN YELLOW-THROAT.—"Common everywhere. Breeds."

Specimens from the coast and interior are apparently inseparable.

**134. Sylvania pusilla pileolata.** PILEOLATED WARBLER.—"More common in the coast region than in the interior. Breeds."

The eight specimens received are all from the coast. Probably the interior form is *Sylvania pusilla.*

**135. Setophaga ruticilla.** AMERICAN REDSTART.—"Common summer resident in the interior. Breeds."

Comparative average measurements of British Columbia and Atlantic Coast specimens are as follows :

British Columbia, 6 specimens, wing, 2.49 ; tail, 2.28 ; exposed culmen, .32.
Atlantic Coast, 6 specimens, wing, 2.57 ; tail, 2.25 ; exposed culmen, 34.

**136. Anthus pensilvanicus.** AMERICAN PIPIT. —"Large flocks were found about the meadows of the coast district during the fall migration."

**137. Cinclus mexicanus.** AMERICAN DIPPER.—"The only specimen seen was shot at Ducks, but before I could secure it it was unfortunately carried beyond my reach in the swift current of a creek."

**138. Galeoscoptes carolinensis.** CAT-BIRD.—"Very common summer resident of the interior, reaching the coast in reduced numbers. Arrived about June 5. Breeds."

I am not aware that this species has been before recorded as breeding west of the Coast range.

Comparative average measurements of British Columbia and Atlantic Coast specimens are as follows :

British Columbia, 6 specimens, wing, 3.68 ; tail, 3.90 ; exposed culmen, .66.
Atlantic Coast, 6 specimens, wing, 3.62 ; tail, 3.84 ; exposed culmen, .63.

**139. Salpinctes obsoletus.** ROCK WREN.—"Rather common about Ashcroft. Breeds."

An adult male in worn plumage taken June 20 is more heavily streaked below than any specimen in a series of thirty examples from Arizona and California. Fully grown young were taken July 9.

**140. Thryothorus bewickii spilurus.** VIGOR'S WREN.—"More common on the coast than in the interior. This is one of the superior song birds of the northwest. Not infrequently I have heard it sing while flying."

The specimens received are all from the coast district, and agree with California examples.

**141. Troglodytes aëdon parkmani.** PARKMAN'S WREN.—"Common summer resident everywhere. Breeds."

With the exception of a young bird from Ducks the twelve specimens received are from the coast. It is a puzzling series. We would expect from this region a form darker than the Californian bird, while on the contrary we find these specimens average lighter, and that several are pale enough to be referred to fairly typical *aztecus*. The flanks, however, are not so heavily barred as they are in Arizona examples.

**142. Troglodytes hiemalis pacificus.** WESTERN WINTER WREN.—"Confined principally to the coast region. Breeds."

The specimens received are all from the coast. A young bird in first plumage was taken May 22.

**143. Cistothorus palustris paludicola.** TULE WREN.—"Found in the interior only. Common about the marshy borders of mountain lakes. Breeds."

**144. Certhia familiaris occidentalis.** CALIFORNIA CREEPER. —"Not uncommon on the coast. Only one seen in the interior."

The single specimen received from Ducks, a bird of the year, taken August 12, is perhaps referable to *C. f. montana.*

**145. Sitta carolinensis aculeata.** SLENDER-BILLED NUTHATCH.—"Very common in the interior. Breeds."

**146. Sitta canadensis.** RED-BREASTED NUTHATCH.—"Common both on the coast and in the interior."

Two specimens, one taken at Westminster, May 8, the other at Ducks, August 1, are sexed as "♀," but have the crown jet black as in the male.

**147. Sitta pygmæa.** PIGMY NUTHATCH.—"Found only at Ducks, where it was as common as the two preceding species."

**148. Parus atricapillus septentrionalis.** LONG-TAILED CHICKDEE.—"Common throughout the valleys of the interior. In the higher mountains it was usually replaced by *Parus gambeli.*"

Four specimens received from Ashcroft, three of which are birds of the year, are at once distinguished from adults of *Parus a. occidentalis* by their lighter coloration. On comparing these young birds with *occidentalis* in a similar stage of plumage, the differences in coloration are not so marked as in the adults but still are evident.

**149. Parus atricapillus occidentalis.** OREGON CHICKADEE. —"Common in the coast region."

An almost fully-grown male was taken at Mt. Lehman, June 9.

**150. Parus gambeli.** MOUNTAIN CHICKADEE.—"Abundant about the mountains of the interior. Breeds."

**151. Parus rufescens.** CHESTNUT-BACKED CHICKADEE.— "Common in the coast region. Breeds."

Fall specimens have the throat black, the head with only a slight brownish cast.

**152. Regulus satrapa olivaceus.** WESTERN GOLDEN-CROWNED KINGLET.—"Very common spring and fall migrant; a few remain to breed."

All the specimens received are from the coast. Young in first plumage were taken at Mt. Lehman, June 14 and 17.

**153. Regulus calendula.** RUBY-CROWNED KINGLET. — "Found only in the coast region during the autumnal migration."

The eleven specimens received differ from eastern specimens in the same manner and to about the same degree as does *Regulus satrapa olivaceus* from its eastern ally. That is, they *average* darker and smaller. The differences, however, are too inconstant to warrant their subspecific separation, and we may well leave this "incipient local form" for the "net" of future ornithologists. Comparative average measurements of five eastern and Pacific Coast specimens are as follows:

Pacific Coast specimens, wing, 2.20; tail, 1.66; exposed culmen, .29.
Eastern specimens, wing, 2.30; tail, 1.71; exposed culmen, .30.

**154. Turdus fuscescens salicicolus.** WILLOW THRUSH.— "Common in the interior. Breeds."

Captain Bendire informs me that the previously most northern discovery of the nest of the species is at Sassin near Spokane Falls, from where he has recently received a nest and four eggs, taken June 7, 1890, with the female, a capture which he permits me to record here.

Mr. Streator's observations further extend this bird's range, and show it to be a common summer resident at least as far north as Ducks and Ashcroft.

A specimen in fall plumage from Ducks is darker than spring birds from Ashcroft, and is remarkably close to spring specimens of *Turdus ustulatus* from the coast. A young male in spotted plumage, taken at the same locality, August 8, is very different from *Turdus fuscescens* of nearly the same age. The light centres to the feathers of the upper parts are buffy, not tawny, while the wings and tail are russet olive, not tawny brown. The differences are thus similar to those shown by the adults of both forms, but are more pronounced.

**155. Turdus ustulatus.** RUSSET-BACKED THRUSH.—"Very common in the coast region. Breeds."

**156. Turdus aonalaschkæ.** DWARF HERMIT THRUSH.— "Found only during the autumnal migration, and in the coast region."

**157. Merula migratoria propinqua.** WESTERN ROBIN.—"Very common everywhere. Breeds."

**158. Hesperocichla nævia.** VARIED THRUSH.—"Common spring and fall migrant. A single pair was found breeding at Mt. Lehman."

**159. Sialia mexicana.** WESTERN BLUEBIRD.—"Not very common on the coast, but abundant summer resident in the interior."

A male taken at Westminster, May 22, has only a trace of rufous in the scapulars, and the blue of the throat almost divides the chestnut collar below. This specimen, therefore, nearly agrees with the description of *Sialia m. anabelæ* Anthony, and also with Swainson's original description of *Sialia mexicana*, in which no mention is made of chestnut scapulars.

**160. Sialia arctica.** MOUNTAIN BLUEBIRD.—"I found one or two pairs of this species breeding in the mountains near Ashcroft. One male was collected."

No specimens received.

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TABLE GIVING THE NUMBER OF SPECIMENS OF EACH SPECIES CONTAINED IN MR. STREATOR'S COLLECTION, AND ALSO THE LOCALITIES AT WHICH THEY WERE OBTAINED.

| | Westminster Junction, B. C. | Mt. Lehman, B. C. | Ashcroft, B. C. | Ducks, B. C. | Vancouver Isl., B. C. | Kalama, Wash. | Ilwaco, Wash. |
|---|---|---|---|---|---|---|---|
| Colymbus holbœlli | | | | | | | 1 |
| Brachyramphus marmoratus | | | | | | | 1 |
| Larus glaucescens | | | | | | | 3 |
| " occidentalis | | | | | | | 11 |
| " californicus | | | | | | 1 | 7 |
| " brachyrhynchus | | | | | | | 7 |
| " heermanni | | | | | | | 2 |
| " philadelphia | | | | | | 1 | 3 |
| Fulmarus g. glupischa | | | | | | | 5 |
| Phalacrocorax p. robustus | | | | | | | 1 |
| Lophodytes cucullatus | | | | 1 | | | |
| Anas boschas | | | 1 | | | | |
| " carolinensis | | | 3 | | | | |
| Aix sponsa | | 2 | | | | | |
| Charitonetta albeola | 1 | | | | | | |

| | Westminster Junction, B. C. | Mt. Lehman, B. C. | Ashcroft, B. C. | Ducks, B. C. | Vancouver Isl., B. C. | Kalama, Wash. | Ilwaco, Wash. |
|---|---|---|---|---|---|---|---|
| Oidemia perspicillata | | | | | | | 9 |
| Anser a. gambeli | | | | | 1 | | |
| Olor columbianus | | | | | | | 1 |
| Grus canadensis | | | | | | 1 | |
| Porzana carolina | | | 1 | 1 | | | |
| Crymophilus fulicarius | | | | | | | 1 |
| Gallinago delicata | | | | 1 | | | |
| Macrorhamphus scolopaceus | | | | 1 | | | |
| Tringa minutilla | | | | 6 | | | |
| " a. pacifica | | | | | | | 10 |
| Ereunetes pusillus | | | | 1 | | | |
| " occidentalis | | | | 1 | | | |
| Totanus flavipes | | | | 1 | | | |
| " s. cinnamomeus | | | | 2 | | | |
| Actitis macularia | | | | 6 | | | |
| Dendragapus o. fuliginosus | 2 | | | | | | |
| " o. richardsonii | | | 8 | | | | |
| Bonasa u. togata | | | | 6 | | | |
| " u. sabini | 3 | 6 | | | | | |
| Pediocætes p. columbianus | | | | 8 | | | |
| Columba fasciata | 3 | | | | | | 1 |
| Zenaidura macroura | | | | 2 | | | |
| Circus hudsonius | | | | 3 | | | |
| Accipiter velox | 1 | | | 5 | | | |
| " cooperi | | | | 3 | | | |
| " atricapillus | | | | 2 | | | |
| Falco columbarius | | | | | | | 1 |
| " sparverius | | | | 7 | | | |
| Pandion h. carolinensis | 1 | | | | | | |
| Asio accipitrinus | 1 | | | | | | |
| Bubo v. subarcticus | | | | 1 | 1 | | |
| Nyctea nyctea | | | | | | | 1 |
| Glaucidium g. californicum | | 3 | | | | | |
| Ceryle alcyon | 2 | | | 6 | | | |
| Dryobates v. leucomelas | | | 2 | | | | |
| " v. harrisi | 10 | 6 | | | 4 | 2 | |
| " p. gairdneri | 3 | 1 | | | 4 | 4 | |
| " p. oreœcus | | | 1 | 3 | | | |
| Picoides arcticus | | | | 7 | | | |
| Sphyrapicus v. nuchalis | | | 1 | 7 | | | |
| " ruber | 2 | | | | | | |
| Ceophlœus pileatus | 3 | | | | 4 | | |
| Melanerpes torquatus | | | 3 | 5 | | | |
| Colaptes cafer | | | 5 | | | | |
| " " saturatior | 5 | 3 | | | 5 | 3 | |
| Chordeiles virginianus | | | 8 | | | | |
| Trochilus rufus | 4 | 1 | | 1 | | | |
| Tyrannus tyrannus | 2 | | | 6 | | | |
| " verticalis | | | 9 | | | | |
| Sayornis saya | | | 1 | 6 | | | |

| | Westminster Junction, B. C. | Mt. Lehman, B. C. | Ashcroft, B. C. | Ducks, B. C. | Vancouver Isl., B. C. | Kalama, Wash. | Ilwaco, Wash. |
|---|---|---|---|---|---|---|---|
| Contopus borealis | 4 | | | | | | |
| " richardsoni | 1 | .... | .... | 5 | | | |
| Empidonax difficilis | 9 | 1 | | | | | |
| " p. trailli | 1 | 2 | 2 | 1 | | | |
| " hammondi | 2 | 1 | 3 | 3 | | | |
| Otocoris a. merrilli | .... | .... | 2 | | | | |
| Pica p. hudsonica | .... | .... | 3 | 5 | | | |
| Cyanocitta stelleri | 14 | 3 | .... | .... | 5 | 1 | |
| " " annectens | .... | .... | .... | 6 | | | |
| Corvus americanus | .... | .... | 4 | .... | .... | 1? | |
| " caurinus | 3 | 1 | .... | .... | 6 | .... | 1 |
| Picicorvus columbianus | .... | .... | .... | 8 | | | |
| Sturnella m. neglecta | 1 | 1 | 3 | 3 | .... | 1 | |
| Icterus bullocki | .... | .... | 1 | | | | |
| Scolecophagus cyanocephalus | .... | 1 | .... | 2 | | | |
| Coccothraustes v. montana | .... | .... | .... | 4 | | | |
| Carpodacus p. californicus | 8 | 1 | .... | .... | 1 | 3 | |
| Loxia c. minor | .... | 1 | .... | 3 | | | |
| Spinus pinus | 10 | .... | .... | .... | .... | 2 | |
| Poocætes gramineus | .... | .... | 8 | | | | |
| Ammodramus sandwichensis | .... | 1 | .... | .... | 1 | 1 | 1 |
| " " alaudinus | 11 | 5 | .... | 1 | 5 | 3 | 1 |
| Zonotrichia l. intermedia | 2 | 3 | .... | 3 | 1 | | |
| " coronata | 5 | .... | .... | .... | 2 | 4 | |
| Spizella s. arizonæ | .... | .... | 4 | 3 | | | |
| Junco h. oregonus | 7 | 6 | .... | .... | 4 | 1 | |
| " h. shufeldti | .... | .... | 4 | | | | |
| Melospiza f. guttata | 15 | 5 | 4 | .... | 8 | 4 | 1 |
| " lincolni | .. | 4 | .... | 7 | 1 | | |
| Passerella i. unalaschensis | 1 | 1 | .... | .. | 2 | 1 | 3 |
| Pipilo m. oregonus | 7 | .... | .... | .... | 4 | 2 | |
| " m. megalonyx | .... | .... | 3 | | | | |
| Habia melanocephala | 3 | 5 | | | | | |
| Passerina amœna | 1 | .... | 6 | 1 | | | |
| Piranga ludoviciana | 3 | 6 | 2 | | | | |
| Petrochelidon lunifrons | .... | .... | 2 | | | | |
| Chelidon erythrogaster | 2 | | | | | | |
| Tachycineta bicolor | 5 | | | | | | |
| " thalassina | .... | .... | 2 | | | | |
| Stelgidopteryx serripennis | 5 | .... | .... | 2 | | | |
| Ampelis cedrorum | .... | 1 | 2 | 5 | | | |
| Lanius borealis | .... | .... | .... | .... | 2 | | |
| Vireo olivaceus | .... | .... | 2 | 6 | | | |
| " gilvus | 7 | .... | 3 | | | | |
| " s. cassinii | .... | .... | 1 | 1 | | | |
| Helminthophila celata | .... | .... | .... | 3 | | | |
| " " lutescens | 4 | 1 | | | | | |
| Dendroica æstiva | 8 | 2 | 3 | 1 | | | |
| " coronata | 1 | .... | .... | .... | 2 | | |
| " auduboni | 4 | .... | 1 | 2 | | | |

| | Westminster Junction, B. C. | Mt. Lehman, B. C. | Ashcroft, B. C. | Ducks, B. C. | Vancouver Isl., B. C. | Kalama, Wash. | Ilwaco, Wash. |
|---|---|---|---|---|---|---|---|
| Dendroica nigrescens | 2 | 6 | | | | | |
| " townsendi | .... | 1 | | | | | |
| Seiurus n. notabilis | .... | .... | .... | 2 | | | |
| Geothlypis macgillivrayi | 4 | 2 | .... | 2 | | | |
| " t. occidentalis | 3 | .... | .... | 5 | | | |
| Sylvania p. pileolata | 4 | 4 | | | | | |
| Setophaga ruticilla | .... | .... | 1 | 6 | | | |
| Anthus pensilvanicus | .... | 9 | .... | .... | .... | 3 | |
| Galeoscoptes carolinensis | .... | 2 | 1 | 3 | | | |
| Salpinctes obsoletus | .... | .... | 3 | | | | |
| Thryothorus b. spilurus | 4 | 4 | .... | .... | 4 | 1 | |
| Troglodytes a. parkmani | 6 | 4 | .... | 1 | | | |
| " h. pacificus | 7 | 4 | .... | .... | 5 | 3 | |
| Cistothorus p. paludicola | .... | .... | 1 | 4 | | | |
| Certhia f. occidentalis | .... | 7 | | | | | |
| Sitta c. aculeata | .... | .... | 1 | 6 | | | |
| " canadensis | 4 | 1 | 1 | 2 | | | |
| " pygmæa | .... | .. | .... | 8 | | | |
| Parus a. septentrionalis | .... | .... | 4 | | | | |
| " a. occidentalis | 4 | .... | .... | 9 | .... | 5 | |
| " gambeli | .... | .... | 4 | 5 | | | |
| " rufescens | 5 | 7 | .... | .... | 5 | | |
| Regulus s. olivaceus | 1 | 5 | .... | .... | 2 | 1 | |
| " calendula | 1 | 6 | .... | .... | .... | 4 | |
| Turdus f. salicicolus | .... | .... | 2 | | | | |
| " ustulatus | 5 | 3 | | | | | |
| " aonalaschkæ | .... | 3 | | | | | |
| Merula m. propinqua | 5 | 2 | .... | .... | 6 | 1 | |
| Hesperocichla nævia | 4 | 4 | .... | .... | 2 | 4 | |
| Sialia mexicana | 2 | .... | .... | 6 | | | |

ARTICLE VIII.—*Descriptions of a New Species and a New Subspecies of the Genus Lepus.* By J. A. ALLEN.

The American Museum has recently received from Mr. E. C. Thurber a specimen of a Hare, allied to but very distinct from *Lepus trowbridgei*, collected at San Fernando, Los Angeles County, California. It may be characterized as follows:

## **Lepus cinerascens,** sp. nov.

Type, No. $\frac{2883}{2302}$, ♀ ad., San Fernando, Los Angeles Co., Cal., March 22, 1890; collected by E. C. Thurber. On the label is written by the collector, "Contained four fœtuses."

Length (head and body), 294 mm.; tail, 24; nose to ear, 72; nose to eye, 28 (collector's measurements from the specimen in the flesh); height of ear from notch, 58; length of hind foot (to end of nails), 63 (last two measurements from the skin).

Skull: basilar length, 48 mm.; total length, 62; greatest breadth, 29; breadth at postorbital construction, 10; length of nasals, 25; width of nasals at front border, 7; greatest width of nasals posteriorly, 12; length of lower jaw, 42; height of lower jaw at condyle, 27; length of upper molar series at alveolar border, 6; width of palatal shelf opposite first true molar, 9.5; least length of palatal shelf, 5.5.

Post-orbital processes very slender, not touching the brain case posteriorly.

General color above (in the spring or breeding pelage), gray mixed with blackish brown, the sides clear gray, the dorsal region pale buffy gray; lower surface grayish white, the hairs at base light plumbeous; breast band brownish gray; nape pale brownish rusty; anterior surface of fore limbs dull yellowish brown; upper surface of hind feet white, of fore feet soiled white; sides of both fore and hind feet grayish brown; soles yellowish brown; tail dark gray above, white below with the terminal third gray; ears very thinly haired, nearly naked (the skin showing through over most of the surface, both externally and internally), brownish gray, without black at the tip or any black or white edging (probably with a narrow white fringe along the basal half of the anterior border in full winter pelage); feet scantily furred; eye enclosed by a whitish area, which broadens into a distinct spot behind the posterior canthus, and also in front of the eye.

This is a small, semidesert form, representing in the arid interior of Southern California the much larger, darker *L. trowbridgei* of the coast region of Central California, from which it differs in its coarse instead of soft, fine pelage, in the pale buffy gray instead of dull chestnut brown of the upper surface, and its much smaller size, *L. cinerascens* being but little more than half the bulk and weight of *L. trowbridgei*.

## **Lepus sylvaticus floridanus,** subsp. nov.

Type, No. $\frac{1890}{1155}$, ♀ ad., Sebastian River, Brevard Co., Fla., March 18, 1889; collected by Frank M. Chapman.

Length of head and body, 455 mm.; tail to end of hairs, 65 (collector's measurements from the fresh specimen); length of hind foot (to end of nails), 84; height of ear from notch, 57 (last two measurements from the skin).

Skull: basilar length, 57 mm.; total length, 72; greatest breadth, 44; breadth at postorbital construction, 21; length of nasals, 29; width of nasals in front, 9.5; greatest width of nasals posteriorly, 16; length of lower jaw, 58; height of lower jaw at condyle, 37; length of molar series at alveolar border, 24; breadth of palatal shelf opposite first true molar, 10.5.

Above mixed buffy gray and black, the black prevailing, especially posteriorly, instead of yellowish brown slightly varied with black as in ordinary *L. sylvaticus;* nape and the usual brown areas of the fore and hind limbs much darker rufous than in northern examples; below the white areas are grayer, and the color of the sides encroaches further upon the ventral surface; breast band broader and darker; ears darker, more scantily haired, and more broadly edged and tipped with black; light area in front of and surrounding the eye grayish white instead of creamy white. The feet are also much less heavily furred.

A young specimen, less than one-fourth grown, shows the same dark colors as the adult, thus differing strikingly from young of the northern form of corresponding age.

The skull indicates the size to be about one-tenth less than in average northern specimens.

Specimens from Gainesville, central Florida, are darker than specimens from North Carolina and Louisana, but are nearer the northern *L. sylvaticus* than the South Florida form above characterized.

ARTICLE IX.—*List of Mammals collected by Mr. Clark P. Streator in British Columbia, with Descriptions of two New Subspecies of Sciurus.* By J. A. ALLEN.

Following is a list of the mammals collected for the American Museum of Natural History during the summer of 1889, by Mr. Streator in British Columbia. The localities at which the specimens were obtained have been already described in Mr. Chapman's report on the birds (see *antea*, p. 123) and need not here be repeated. The collection numbers about 140 specimens, representing 20 species. Mr. Streator's field notes are given in quotation marks in their proper connection.

The series of Squirrels, of the genera *Sciurus* and *Tamias*, proved most interesting and instructive, throwing much light on the distribution of the several forms in British Columbia. The Cascade Range appears to sharply limit the two coast forms, *Sciurus hudsonius douglassi* and *Tamias townsendii*, at the eastward, they being replaced in the interior respectively by *Sciurus hudsonius richardsoni* and *Tamius quadrivittatus affinis*. The form of *Sciurus* found on Vancouver Island proves unexpectedly to be not referable to *S. hudsonius douglassi* but to be a well-marked insular form, in some respects resembling *S. hudsonius richardsoni*.

**1. Putorius vison** (*Schreber*). MINK.—"Common throughout the Province."

One specimen, Ducks, August 4.

**2. Mephitis mephitica** (*Shaw*). SKUNK.—"Common in the interior. Skins that I saw from the coast region appeared to represent a much smaller species."

A half-grown specimen, without data, the label having become detached and lost.

**3. Ursus americanus** *Pallas*. BLACK BEAR.—Represented by a single skull of a half-grown specimen. Locality not stated.

**4. Vesperugo fuscus** (*Bauvais*). BROWN BAT.—One specimen, Mt. Lehman, June 15; the only specimen seen by the collector.

**5. Vespertilio nitidus** *H. Allen*. CALIFORNIAN BAT.—"Common in the coast region."

Three specimens, Westminster, April 24, and one without label (probably from Mt. Lehman), are provisionally referred to this species. The first three are very dark, the other somewhat lighter in color.

**6. Sorex suckleyi** *Baird.* SUCKLEY'S SHREW.—"Common in the coast region, but no indications of them were noticed in the interior."

Five specimens (Westminster, April 30–May 10, four specimens, two adult and two half grown; Mt. Lehman, June 6, adult female) are provisionally referred to this species.

**7. Sciurus hudsonius richardsoni** (*Bachman*). RICHARDSON'S CHICKAREE.—"Common throughout the interior of British Columbia."

Ten specimens, five from Ashcroft, July 8–21, and five from Ducks, August 1–16. Three of the specimens are about two-thirds grown; the others are all adult. They are all clear white below, with a well-defined black lateral line on each side of the body, much broader and blacker in some than in others, at the junction of the dorsal and ventral areas. They vary somewhat in color above, the two extremes being represented by No. 2049, ♀ ad.; Ashcroft, July 9, and No. 2054, ♂ ad., Ducks, August 3. The former is nearly pure olivaceous gray above with no mixture of rufous except on the fore and hind limbs and upper surface of the tail. The other is heavily suffused above with brownish rufous, most strongly on the limbs and upper surface of the tail. The rest are variously intermediate, with a tendency,—in some well marked,—to a broad median dorsal dark reddish brown band. A parallel variation is seen in two young specimens from Ducks, showing that there is a wide range of individual variation in color, irrespective of season. The gray specimens bear a strong resemblance, in the general color of the dorsal surface (excluding the tail), to average Colorado specimens of *Sciurus hudsonius fremonti.*

**8. Sciurus hudsonius douglassi** (*Gray*). DOUGLASS'S CHICKAREE. — "Distributed abundantly throughout the coast region of British Columbia and Washington."

Twenty-eight specimens, as follows: Westminster, B. C., April 21 to May 20, fifteen specimens; Mt. Lehman, B. C., June 2–8, three specimens; Kalama, Washington, October 14–18, five speci-

mens; Cape Disappointment, Washington, November 1–3, five specimens. This large series thus covers the period from April 21 to November 3, and admirably shows the wide range of seasonal variation to which this subspecies is subject.

A male and female, collected at Westminster, April 23, are in breeding pelage, showing only here and there small patches of the post-breeding dress. In these there is barely a faint indication of the black lateral line; the sides of the body above the lateral line are dark gray, with a faint wash of dark brown, which increases in amount toward the dorsal line, and forms the prevailing color for a considerable area along the middle of the dorsal region, from the head to the end of the apical half or third of the tail. Tail above mixed brown and black with a subapical border and a broad subapical tip of black and an outer broad conspicuous fringe of white. Lower surface of the body buff, the hairs broadly dusky at base and narrowly ringed with black near the tips, giving the effect of a plumbeous ground color heavily washed with pale buff. Limbs and upper surface of the feet like the sides. The beginning of the change to the post-breeding pelage is shown by patches of short, pale yellow fur on the chin and sides of the muzzle, and by little tufts of yellowish hair here and there on the ventral surface of the body. In most of the other April specimens the whole ventral surface is more or less mixed with irregularly dispersed patches of the post-breeding pelage. The April specimens still retain the blackish ear-tufts characteristic of the winter dress.

In May specimens the change has considerably advanced. Thus, in No. 2075, ♂ ad., Westminster, May 12, the whole chin, throat, and fore neck, and a quite broad but somewhat irregular median line are bright buffy yellow; the fore limbs, as far as the elbows, and the toes and edges of the hind feet are deep orange yellow. A still more advanced stage is seen in No. 2065, ♂ ad., Mt. Lehman, June 2, in which the new coat has encroached still more upon the ventral surface, has crept farther up on the fore limbs, and covers most of the hind feet, extending to the base of the toes and along the inside of the foot to the lower part of the leg, while the whole top and outer side remains as in early spring. The inner border of the foot is thus bright orange, while the top and outer border are dull brownish gray. The dark line on the

sides of the body is still indistinct, and, with the exception of the parts named, the pelage is nearly as in April examples.

In a July specimen, collected in Pacific County, Washington, by Mr. A. H. Helme, July 17, 1885, the whole lower surface and both fore and hind feet are deep ochraceous orange; the black lateral line is broad and intense black, and the broad dorsal band of dark rufous has disappeared, leaving the whole dorsal area dull dark brown, washed with pale yellowish or olivaceous gray. The tail is fringed broadly with yellowish white instead of pure white. Mr. Streator's October and November specimens are similar, and in striking contrast with his April and May specimens.

The change is thus parallel in character to the seasonal changes occurring in the Eastern Chickaree (see this Bulletin, Vol. III, pp. 41–44), but much more strongly marked.

Besides the seasonal variation in color in this subspecies, there is also a wide range of individual variation, especially in the color of the ventral surface. In specimens taken in March and April the ventral surface in about one specimen in ten is pale buff, varying from this to very strong buff or faint ochraceous. In post-breeding pelage the ventral surface varies from pale ochraceous yellow to deep ochraceous orange. The dorsal surface varies in spring specimens from a dark fuscous gray with only the faintest or even no tinge of rusty to a strong shade of dark rusty brown over the middle third of the dorsal region, with a faint tinge of the same color on the sides of the body. In fall specimens the middle of the back is more or less tinged with dark rusty. The edging of the tail varies from clear white to yellowish or rusty white, in spring as well as in fall specimens.

The principal differences observable between *S. h. richardsoni* and *S. h. douglassi* are the much smaller and more heavily-clothed ears, longer tail, softer and fuller pelage, and the absence of ochraceous on the ventral surface in the former as compared with the latter. When series of the two forms are placed side by side with the backs uppermost, *douglassi* averages darker and browner in coloration, with much less rufous in the tail, but the range of individual variation in color quite overlaps the average difference. When the same series are placed side by side with the ventral surface uppermost there is a strong contrast between even the palest specimen of *douglassi* and the *richardsoni* series.

**9. Sciurus hudsonius vancouverensis,** subsp. nov. VANCOUVER CHICKAREE.

"Common on Vancouver Island."

Six specimens from Duncan's, Vancouver Island, October 1–9, are strikingly different from either *S. h. douglassi* or *S. h. richardsoni*, being in some respects intermediate between them. They wholly lack the ochraceous color below of *douglassi*, in this resembling *richardsoni*. The color above is rather darker and browner than in either, but most resembles that of *douglassi*. It has also the small low ears of that form, as compared with the much larger ears of *richardsoni*. While of about the same general size, the tail (judging from the skins) is one-fifth shorter than in either, but broader, more bushy, and very differently colored. This form may be characterized as follows:

*Post-breeding Pelage.*—Similar to *S. h. douglassi* in general size, in the size and form of the ears, and in the general coloration of the dorsal surface; below white, as in *S. h. richardsoni*; tail short (6 inches or less to end of hairs instead of 7 inches or more, as in *richardsoni*), broad and very full; tail above dark reddish brown varied with black, without a conspicuous lighter fringe, the apical fourth to third deep black. The coloration of the tail is much as in some specimens of *richardsoni*, but the black of the apical portion is broader and less mixed with red, while the usual light fringe formed by the tips of the hairs of the sides and end of the tail, found in the allied forms, is almost wholly absent, the tips of the lateral hairs being scarcely lighter in color than those covering the upper surface.

Length of head and body (measurements from skins), 6.50 to 7.50 in. (165–190 mm.); tail to end of vertebræ, 4.60 to 5.00 (117–127); tail to end of hairs, 5.80 to 6.40 (147–163); hind foot, 1.70 to 1.80 (43.2–45.7); height of ear from crown, .50 (12.7).

Type, No. 2059, ♀ ad., Duncan's, Vancouver Island, Oct. 2, 1889; C. P. Streator.

A second undescribed form of this group, represented by eight specimens from the Sierra Nevada, Placer County, California, may be thus indicated:

**Sciurus hudsonius californicus,** subsp. nov. CALIFORNIA CHICKAREE.

?? *Sciurus mollipilosus* AUDUBON & BACHMAN, Proc. Acad. Nat. Sci. Phila., I, 1842, p. 102; Journ. Acad. Nat. Sci. Phila., VIII, 1842, p. 316.

Size of *S. h. douglassi*, but with much larger ears and very different coloration.

*Post-breeding Pelage* (Oct. 7–14).—Above dark olivaceous gray, varied with yellowish rufous; fore limbs as far as the elbows yellowish rufous; hind feet rusty yellow; a distinct broad black lateral line; below white, varying in different specimens to pale creamy white; outer edge of thighs yellowish; tail above dark reddish brown mixed with black centrally on the basal half, bordered broadly with black and very heavily fringed with pure white; tail below black varied with white and broadly edged with pure white. In some specimens the tail above is gray centrally with barely a trace of rufous, with very broad white

margins, the hairs being more or less rusty towards the base, then broadly ringed with black and tipped with white. Ears blackish on the anterior and apical edges, and distinctly tufted with blackish. In some specimens a band down the middle of the dorsal region is distinctly rusty, as in the other forms of the group.

Length of head and body (collector's measurements from the fresh specimens), 8 in. (203 mm.); tail to end of hairs, 6.50 (165); hind foot, 2.00 (51); height of ear from crown, .60 (15.3.).

Type, No. 2551, ♀ ad., Blue Cañon, Placer Co., Cal., Oct. 13, 1886; C. A. Allen.

These specimens, as regards season, are strictly comparable with Mr. Streator's series from Kalama and Cape Disappointment (mouth of the Columbia River), and also with the Vancouver Island series. The latter represent an insular white-bellied form (*vancouverensis*); the Columbia River specimens represent the form with the deep orange or ochraceous ventral surface (true *douglassi*); while the Blue Cañon series represent a form with pale creamy white (varying to pure white) underparts (*californicus*). The latter differs from both the others in the lighter, more yellowish-olivaceous gray of the dorsal surface, in strong contrast with the reddish-fuscous gray of the two northern forms.

*Californicus* differs also from the others in the broad snowy white border to the tail, in contrast to the narrower, more or less yellowish white of *douglassi*, and the almost entire absence of a distinctly lighter border in *vancouverensis*. In respect to the coloration of the tail, and of the dorsal surface generally, *californicus* and *vancouverensis* represent the extreme phases of what may be called the *douglassi* group.

In the coloration of the dorsal surface *californicus* much resembles *S. h. fremonti*, but the latter is pure clear white below and has the very large ears characteristic of the interior forms (*richardsoni*, *fremonti*, and *mogollonensis*).

Doubtless *californicus* has a considerable geographical distribution in California, but over just what area cannot now be determined. Fort Crook specimens, at least the light-bellied ones, as I now recall them (see Mon. N. Amer. Roden., pp. 679–681, and *passim*), being doubtless referable to what is here named *californicus*.

*Sciurus mollipilosus* Bachman, from "the northern parts of California," may refer to the present form, but it is too inadequately described for recognition. "The inner surface of the fore legs, the throat and abdomen cinereous, lightly tinged with

rufous," and "a few of the hairs [of the tail] are tipped with grey," does not apply to the form here described.

**10. Tamias townsendii** *Bachman.* TOWNSEND'S CHIPMUNK. —"Abundant throughout the coast region of British Columbia and Washington."

Nineteen specimens, as follows: Westminster, May 15, one; Mt. Lehman, June 5–15, nine; Kalama, Oct. 15–20, four; Cape Disappointment, Nov. 1–11, five. None were obtained on Vancouver Island, where, Mr. Streator was informed by the residents, it does not occur.

**11. Tamias quadrivittatus affinis** *Allen.* COLUMBIAN CHIPMUNK.—"Abundant throughout the interior of British Columbia."

Ten specimens, all from Ashcroft, collected June 18 and 19, and July 3–8. As already noted (see *antea*, pp. 103–106), the small Chipmunks of the *T. quadrivittatus* group from British Columbia are strikingly similar in general features to the true *T. quadrivittatus* from Central Colorado, though separated from it by a thousand miles of territory and several quite different intervening conspecific forms.

**12. Hesperomys leucopus austerus** (*Baird*). BAIRD'S WHITE-FOOTED MOUSE.—"Very common in all parts of British Columbia visited."

Nine adult specimens from Westminster, taken April 3 to May 15; one adult female from Mt. Lehman, June 3; three nearly full-grown young from Ducks, Aug. 4–10, and a similar example from Ashcroft, June 18, are typically referable to Baird's *Hesperomys austerus*. This form is very near *H. leucopus arcticus* Mearns (Bull. Am. Mus. Nat. Hist., Vol. II, No. 4, p. 285), from which it differs in much darker colors and larger ears. Specimens from Point Reyes, Cal., are also quite similar.

**13. Neotoma cinerea** (*Ord*). BUSHY-TAILED WOOD RAT.—"Very common throughout the interior of British Columbia."

Six specimens, Ducks, August 1 to Sept. 1. They show much variation in color; the single September specimen is browner than the others, being pale cinnamon rufous above varied with black.

**14. Arvicola (Myonomes) riparius** (*Ord*). MEADOW MOUSE.—Two fully adult specimens from Ducks, taken August 4, and two immature examples from Westminster, taken May 2, I am unable to distinguish from ordinary *A. riparius* of the East. In two of the three skulls preserved the middle upper molar has the usual postero-internal loop ; in the other skull it is absent.

**15. Arvicola (Chilotus) oregoni** (*Bachm.*). OREGON MEADOW MOUSE.—Male and female adult, Ducks, August 4.

**16. Zapus hudsonius** (*Zimm.*). JUMPING MOUSE.—"Frequents the meadows of both the interior and the coast region."

One adult specimen from Mt. Lehman, June, and two not fully grown from Ducks, August. The adult specimen is much larger than the average of eastern examples. The same is true of a specimen from Pacific County, Washington, collected by Mr. A. H. Helme, April 20, 1885.

**17. Fiber zibethicus** (*Linn.*). MUSKRAT.—Three specimens, Ducks, August 2–5.

**18. Thomomys talpoides douglassi** (*Rich.*). OREGON GOPHER.—"Common throughout all parts of the interior of British Columbia I visited."

Five specimens, Ducks, August 8–21. They are all immature, which may account for their small size, as compared with California examples (*T. t. bulbivorus*). They are also very differently colored, being much lighter about the mouth, more rufescent above, and much less tawny below.

**19. Erethizon epizanthus** *Brandt.* WESTERN PORCUPINE. —"Not uncommon in the interior ; less so on the coast."

Represented by a single specimen, unfortunately without a label.

**20. Lepus americanus washingtoni** (*Baird*). WESTERN VARYING HARE.—"Not common ; found only in the coast region."

Represented by a very young specimen and another nearly full grown, from Mt. Lehman, June 14 and Sept. 23.

ARTICLE X.—*Notes on a Small Collection of West Indian Bats, with Description of an apparently New Species.* By J. A. ALLEN.

Mr. Charles B. Cory, the well-known ornithologist, has placed in my hands for study a small collection of Bats, gathered by his collectors in the West Indies. While the collection embraces only about fifteen specimens, they represent eight species, and come mostly from the smaller and little-known islands. One of the species proves to be apparently new to science.

**1. Vesperugo fuscus** *Bauv.*—A single specimen from Nassau, Bahamas, collected in January, 1879, by Mr. Cory, is nearly one-third smaller than average specimens from the United States, with the ears thin and papery instead of thick and leathery, and the wing membranes very delicate. An examination of the skull shows the specimen to be fully adult. In coloration and in all external characters it does not differ appreciably from *V. fuscus*, which presents a wide range of apparently purely individual variation in color, specimens from the same locality, taken at the same season, varying from a light yellowish or golden tint to deep sepia brown.

Following are the measurements of the Nassau specimen, taken from the dry skin: head and body, 55 mm.; tail, 35; ear from base of inner margin, 12; tragus, 5.5; forearm, 33; thumb, 7; third finger (metacarpal, 33; 1st phal., 13; 2d phal., 18), 64; tibia, 15.5; hind foot, 9.

## 2. Natalus micropus.

*Natalus micropus* DOBSON, P. Z. S., 1880, p. 443.

A single specimen from Old Providence Island, ♂ ad., May 10, 1887, seems distinctly referable to this species, described by Dr. Dobson from a Jamaica specimen.

**3. Noctilio mastivus** (DAHL).—One specimen, ♂ ad., Antigua, April 22, 1890. Apparently very distinct from *N. leporinus* (Linn.), differing in its much larger size and very different coloration.

**4. Molossus obscurus** *Geoffr.*—One specimen, Virgin Gorda, ♂ ad., Nov. 30, 1889. Above, deep black, the basal half or two-

thirds of the fur nearly pure white; below, plumbeous black, the basal portion of fur white. Forearm, 37 mm.; third finger, 72, its metacarpal, 38; tail, 41, its apical half exserted beyond the membrane.

**5. Macrotus waterhousei** *Gray.* — One specimen, Nassau, Bahamas, Jan., 1879.

I am also indebted to Dr. John I. Northrop, of the Columbia College School of Mines, New York City, for the opportunity of examining three specimens from Andros Island, Bahamas, taken May 15, 1890.

These specimens differ greatly in coloration from *M. mexicanus* De Sauss., from Mexico, and also in various structural details, as will be pointed out later in connection with the Mexican forms of this genus.

## Artibeus "perspicillatus (*Linn.*)."

The Bats of the *perspicillatus* section of the genus *Artibeus* (molars $\frac{2-2}{3-3}$) from South America, the West Indies, Mexico, and Central America, present a wide range of variation in size, color, and in the distribution of the fur on the limbs, as also to some extent in the size and form of the nose-leaf, the tragus, and in the contour of the skull and the form of the molars. My series of twelve specimens represents the following localities: Tehuantepec, Mexico, ♂ ad. and ♀ juv.; St. Andrew's Island, Caribbean Sea, ♂ ad.; Porto Rico, W. I., two specimens; Anegada, W. I., two specimens; Virgin Gorda, W. I., one specimen; Anguilla, W. I., one specimen; West Indies (without definite locality), one; Yungas, Bolivia, one specimen; Bogota, United States of Colombia, one specimen. The Bolivian example is the largest of the series (metacarpal of third finger 66.5 mm.), with the general color sooty brown (the fur much paler at the base than at the surface, but only brownish gray, not white), with four well-defined and conspicuous light facial streaks, and the fur extending thickly on the forearm as far as the middle, forming a broad triangular area.

The Bogota specimen and the two Mexican (Tehuantepec) examples come next in point of size (metacarpal of third finger, in ♂, 60 mm., in ♀, 49 mm.), and have about the same distribution

of the fur on the limbs, but differ notably in color, being of a dark reddish brown above, lighter and with longer gray tips to the hairs below, with the fur everywhere at base very light (pale fulvous white), with the light facial streaks indistinct.

The specimens from Anguilla, Anegada, and another West Indian specimen from an unknown locality, are of about the same size and of nearly the same color as the smaller Tehuantepec specimen, and have about the same distribution of the fur on the limbs. In all there is a more or less distinct trace of a grayish line running from the outer margin of the base of the nose-leaf to the sides of the forehead opposite the inner base of the ear, on each side of the face. In all the pelage is more or less rufescent.

The Virgin Gorda specimen is of the same size, with the same distribution of fur, but the pelage is not at all rufescent, being dark sooty brown above, and a little lighter below, through the strong grayish tipping of the hairs. The fur is also darker below the surface.

The Porto Rico specimens are slightly larger (metacarpal of third finger 55 mm.). They lack all trace of facial streaks, and the color is dull smoke brown, with the fur scarcely lighter at the base than at the surface, and restricted to the body, even the humeri, as well as the forearms and tibiæ, being quite naked. The wing membranes are smoother, apparently thinner and more delicate, and of a peculiar dark, purplish horn color. In size and color they closely resemble the Virgin Gorda specimen.

The St. Andrew's Island specimen is like the last in size (metacarpal of third finger 55 mm.), but differs greatly from all the others in color and in the distribution of the fur on the forearms, which on the dorsal surface extends densely in a broad band along the humeri and over about the proximal third of the forearm bones. The color above is dark seal brown, the fur lighter (smoky gray) beneath the surface; below lighter and more grayish brown, from the gray tipping the hairs.

The skulls of these specimens differ much in size and proportions, and the molars also vary in form in the different skulls; but the difference is in part doubtless merely individual. It is worthy of note that while the minute last lower molar is present in all, the incisors vary in number, the lower incisors being all

absent in one skull, while two are lacking in another, and one each in two others, while in still another only three upper incisors are present. The size of the skull varies from a length of 33 mm. in the Bolivian specimen to 28 mm. in one of the Porto Rico specimens. The distance across between the outer border of the last upper molar on either side varies in the same skulls from 14 to 12 mm.

The shape of the tragus, particularly the form and position of its serrations, also varies more or less, as does the size and form of the nose-leaf, but these variations, as well as those of the skull and dentition, prove rather unstable.

In respect to coloration the series falls into four pretty strongly-marked groups, as follows,

1. Facial stripes four, grayish white, conspicuous; general color above dark sooty brown, the pelage below the surface smoky gray. Yungas, Bolivia; 1 specimen.
2. Facial stripes two, grayish, very inconspicuous (no stripe from the angle of the mouth); general color above dark rufescent brown, the pelage below the surface nearly pure white. Mexico, Anegada, and Anguilla, W. I.; 5 specimens.
3. No facial streaks; general color above dark sooty brown, the pelage below the surface smoky gray. Virgin Gorda and Porto Rico; 3 specimens.
4. No facial streaks; general color above dark seal brown (brownish black), but very little lighter at the base than at the surface. St. Andrew's Island; 1 specimen.

It may be added that none of the specimens have any white mark of any sort on the shoulder.

With the limited material at hand it is impossible to decide satisfactorily what value to accord these striking differences. It seems probable, however, that they must indicate at least well-marked local phases of a wide-ranging group, and that the Bolivian phase may be specifically separable from the West Indian, Bogota, and Mexican forms. In consequence also of the vagueness of all of the earlier descriptions of the Bats of this group it seems almost impossible to say to which phase belongs the name *Vespertilio perspicillatus* of Linnæus and other early authors, or to allocate the various subsequent names currently treated as synonyms of *Artibeus perspicillatus*.*

* Some thirty years ago Mr. R. F. Tomes (P. Z. S., 1861, p. 64), after synonymizing under this name some half-a-dozen of the species of previous authors adds: "After the examination of many specimens from the West Indian Islands and the continent of America I am fully persuaded that they are all referable to one species, and that that species is the *Vespertilio perspicillatus* of Linnæus. There is, I admit, considerable difference in the size of different individuals, the island specimens being smaller and darker-colored than those from the mainland," etc.

For the present I am disposed to make the following disposition of the West Indian specimens, believing that the differences above detailed are geographical rather than individual, seasonal, or sexual.

**6. Artibeus jamaicensis** *Leach* (?).—Porto Rico, two specimens; Virgin Gorda, one specimen, ♂ ad., Dec. 1, 1889.

**7. Artibeus carpolegus** *Gosse* (?).—Antigua, two specimens, ♂ ad., Dec. 30, 1889; ♀ ad., April 23, 1890. Anegada, one specimen, ♂ ad., Dec. 30, 1889. Cyrus S. Winch, collector.

### 8. Artibeus coryi, sp. nov.

Pelage short, soft, dense, and velvety. Above dusky seal brown, darkest along the sides of the body and posteriorly; below similar but somewhat lighter, with minute grayish tips to the hairs. The fur is nearly as dark at the base as at the surface, both above and below. No trace of white streaks on the face, nor elsewhere. Ears, nose-leaf, feet, and membranes black.

Both above and below the fur extends barely to the edge of the antebrachial membranes, but a narrow band densely covers the humerus, and proximal third of the fore-arm bones. Below the wing membranes are thinly covered with short woolly dusky gray fur to a line extending from about the knee to the elbow, and outwardly for about half an inch beyond the elbow-joint. The interfemoral membrane is well furred below to a point about opposite the knees. The interfemoral membrane is supported by well-developed calcanea, and is emarginate to a point a little below the knees. Ears short, broad, obtusely pointed. Nose-leaf small, pointed, confluent with the muzzle at the base.

Dentition as in *A. perspicillatus*. Inc. $\frac{4}{4}$, c. $\frac{1}{1}$, pm. $\frac{2-2}{2-2}$, m. $\frac{2-2}{3-3}$. Length, head and body (from skin), 73.7 mm. (2.90 in.); head, 23 (.90); nose-leaf, 9 (35), its free portion 4.6 (.18); height of ear (from crown), 11.5 (.45); tragus, 5.1 (.20); forearm, 50.1 (2.00); thumb, 6.4 (.25); third finger, 70 (2.75),—metacarpal, 56 (2.20), 1st phalange, 18 (.70), 2d ph., 28 (1.10), 3d ph., 24 (.95); fifth finger, 58.5 (2.30); tibia, 25.4, (1.00); calcaneum, 7 (.27); foot, 16.5 (.65); interfemoral membrane from point of emargination, 23 (.90).

Type No. $\frac{1648}{2376}$, Am. Mus. Nat. Hist., ♂ ad., St. Andrew's Island, Caribbean Sea, Feb. 12, 1887; C. B. Cory.

This is apparently a well-marked insular form of the West Indian *perspicillatus* group. The single specimen on which the species is based is an old male, taken on St. Andrew's Island, by one of Mr. Cory's collectors, and presented by Mr. Cory, with a number of other West Indian Bats, to the American Museum. The species is named for Mr. C. B. Cory in recognition of his important natural history explorations in the West Indies.

ARTICLE XI.—*Notes on Collections of Mammals made in Central and Southern Mexico, by Dr. Audley C. Buller, with Descriptions of New Species of the Genera Vespertilio, Sciurus, and Lepus.* By J. A. ALLEN.

Since the publication, in October, 1889, of my report on the first collection of mammals made by Dr. Buller in Mexico, the American Museum has received from him two additional collections, containing many species not included in his first shipment, among them several apparently new to science. To make the list complete to date, all of the species thus far received from Dr. Buller are mentioned in the present paper, those contained in the former paper being here briefly entered, with a reference to the fuller record already published.

Dr. Buller's collection of mammals numbers 238 specimens, representing 46 species and subspecies, of which seven proved new to science. Several others were new to the fauna of Mexico, and the habitats of others are extended much beyond their previously known limits. Finally, it is safe to say, Dr. Buller's collection of Mammals is one of the most extensive and important ever received from Mexico from any single collector.

In the preparation of this paper I have been greatly indebted to Dr. C. Hart Merriam, Chief of the Division of Economic Ornithology and Mammalogy of the United States Department of Agriculture, for the loan of material, and especially for the opportunity of comparing some of the obscure species of *Vespertilio* and *Hesperomys* with the types of species recently described by him from Arizona, and also with De Saussure's types of all the latter's Mexican species of "*Hesperomys*," fortunately just at present in Dr. Merriam's possession, De Saussure's types having been generously loaned him by the authorities of the Musée d'Histoire Naturelle de Ville de Genève for examination. I am also indebted to Mr. F. W. True, Curator of the Department of Mammals in the United States National Museum, for the opportunity of examining other authentic specimens of De Saussure's species (some of them labeled by De Saussure himself), and also the type of Dr. Coues's *Hesperomys melanophrys*, as well as a good series of Merida specimens of *Lepus*.

**1. Ateles vellerosus** *Gray.*—Female, skin and skull, and male, skull, Chimalapa, Tehuantepec, March 17 and 26, 1890.

**2. Felis onca** *Linn.*—Skull of a female from the coast range, below Colima, Jan. 15, 1890.

**3. Felis tigrina** *Erxl.*—An imperfect hunter's skin, without data.

**4. Felis pardalis** *Linn.*—An imperfect hunter's skin, male, Colima, Jan. 15, 1890.

**5. Felis yaguarundi** *Desm.*—Two imperfect flat skins, without data.

**6. Putorius brasilianus frenatus** (*Stew.*).—One specimen, Tepic. (See this Bulletin, II, p. 165.)

**7. Urocyon virginianus** (*Schreber*).—One specimen (without skull), male, Santo Domingo, Tehuantepec, April 25, 1890. It is much smaller than United States specimens, and more strongly colored throughout. It doubtless represents a form well worthy of subspecific recognition.

**8. Procyon lotor hernandezi** (*Wagler*).—One specimen, a female but little more than half grown, Tehuantepec City, Feb. 28, 1890. It agrees well with Arizona specimens in color, which differ much in this respect, as well as in size, from specimens from Eastern North America, and especially from Florida specimens.

**9. Vesperugo fuscus** (*Beauv.*).—Two specimens, males, Sierra de Colima, Jalisco, Dec. 7, 1890. (See also this Bulletin, II, p. 165.)

**10. Antrozous pallidus** (*Le Conte*).—Eleven specimens, one male and ten females, Sta. Cruz del Valle, Guadalajara, Jalisco, Sept. 7 and 8, 1889. Not appreciably different from specimens from Fort Verde, Arizona, collected by Dr. Mearns.

Not previously reported from south of the northern boundary of Mexico.

**11. Plecotus (Corinorhinus) townsendi** (*Cooper*).—One specimen, male, San Pedro, Guadalajara, September 27, 1889.

Not previously recorded from Mexico.

**12. Atalapha cinerea** (*Beauv.*).—One specimen, male, Hidalgo San Marcos, Tonila, Jalisco, Dec. 5, 1889. Apparently not different from California examples. (See also this Bulletin, II, p. 165.)

**13. Vespertilio lucifugus** *Le Conte.*—One specimen, male, Sierra de Colima, Jalisco, December 6, 1889.

**14. Vespertilio nitidus** *H. Allen.*—Two specimens, males, Sierra de Colima, Jalisco, Dec. 6, 1889. These specimens appear to be not typical, either in size or color, and their reference to this species is provisional.

## 15. Vespertilio velifer, sp. nov.

Size of *V. albescens*, with nearly the coloration of *V. nitidus*, and the ears of *V. subulatus*.

Above basal two-thirds of the fur blackish, passing into dark broccoli brown at the surface; below much paler, the surface pale buffy gray. Pelage full and soft, extending on the membranes about as in *V. lucifugus*. Ears of medium size, similar in general form to those of *V. subulatus*, but rather narrower and more attenuate at the tip, the upper posterior third distinctly hollowed, the lower third abruptly much expanded; tragus long, rather narrow, fully or rather more than half the length of the ear, the front border nearly straight, the posterior border slightly rounded as far as a little beyond the middle, then sloping gradually to the rather narrow but rounded tip, with a distinct notch opposite the anterior base.

Wings from the base of the toes; calcaneun strongly developed; feet large; thumb short, stout, with a rather thick claw; tip of last caudal vertebra free.

Length of head and body (measurements from dry skin), 44 mm.; tail, 33; ear from base of inner margin, 14; tragus, 9; forearm, 42; thumb, 8; third finger (metacarpal, 38; 1st phal., 13; 2d phal., 12; 3d phal., 10), 73; tibia, 17; foot, 11.

Skull broad, rather short; basilar length 14; total length, 16; greatest width, 10.5; lower jaw (front border to condyle), 13. First upper premolar about twice the size of the second, both placed on the inner border of the tooth row.

Type, 2696, ♂ ad., Sta. Cruz del Valle, Guadalajara, Jalisco, Sept. 7, 1889, Dr. A. C. Buller.

Three specimens, one male and two females, and six additional skulls, Sta. Cruz del Valle, Guadalajara, Jalisco, Sept. 7 and 8, 1889.

These specimens agree very closely in size and coloration, and in all other characters, and represent an apparently new species,

quite different from any heretofore described. Its large size readily distinguishes it from any other known Mexican or North American species of the genus, except *V. albescens* Geoffroy, which it appears to equal in size, while differing from it almost as widely as possible in coloration, and also greatly in the size and form of the ear, and in the very differently shaped tragus. Fortunately a Maximilian specimen of *V. leucogaster* Wied, a species currently synonymized with *V. albescens* (see Dobson, Cat. Chirop., pp. 326, 327), in the American Museum, enables me to make a direct comparison of *V. albescens* with the present species.

**16. Vespertilio melanorhinus** *Merriam.*—Seven specimens, four males and three females, Sierra Nevada de Colima, altitude 7500 feet, Jalisco, Dec. 6 and 7, 1889. "Taken while drinking at a water-trough."

The series varies in color above from golden brown to dull yellowish brown, irrespectively of sex, the brightest specimens, and also the darkest, including both males and females.

The series has been compared with the type of *V. melanorhinus*, to which the specimens seem distinctly referable.

**17. Saccopteryx plicata** (*Peters*).—This rare species, originally described from a Costa Rican specimen, and only once before reported from Mexico (*cf.* Alston, Biol. Centr.-Am., p. 29), is represented by two skins (males), and eleven specimens in alcohol, collected at Tehuantepec, Feb. 12, 1890. Of the thirteen specimens nine are males and four are females. In the latter the wing sac is rudimentary.

**18. Nyctinomus brasiliensis** *I. Geoffr.*—Nine skins and skulls and eight additional skulls, about equally divided between males and females, all from Sta. Cruz del Valle, Guadalajara, Oct. 5, 1889, except two, taken at San Pedro, Guadalajara, Oct. 16, 1889. There appears to be no sexual variation in size.

The length of the forearm varies from 39 to 43 mm., averaging 41.3. Traces of a gular pouch are distinctly seen in four of the five males, but there is no indication of it in any of the four females.

**19. Pteronotus davyi** *Gray.*—One specimen, male, Plains of Colima, Jan. 15, 1890.

## 20. Macrotus bulleri *H. Allen.*

*Macrotus californicus* J. A. ALLEN, Bull. Am. Mus. Nat. Hist., II, No. 3, p. 166 (Oct. 21, 1889).

*Macrotus bulleri* H. ALLEN, Proc. Am. Phil. Soc., XXVIII, p. 73 (April 14, 1890).

Five specimens (skins), three males and two females, and an additional skull, San Pedro, Guadalajara, Sept. 27, 1889. These are additional to the eleven specimens already recorded from Bolaños (l. c.), and provisionally referred to *M. californicus.*

The series from Bolaños, Northern Jalisco, were taken in July; the series from Guadalajara, Central Jalisco, were collected in September. There is no appreciable difference in coloration in the two series. Above the color is nearly uniform dark plumbeous, with the basal half of the fur pure white; below the color is much lighter and more grayish. The length of the forearm varies from 42 to 48 mm., averaging 45.

On sending the Bolaños specimens to Dr. H. Allen, the well-known specialist in Chiroptera, some time after the publication of my paper on Dr. Buller's first collection of Mexican mammals, Dr. Allen found them to be specifically different from *M. californicus*, and later described them as above cited.

## 21. Macrotus mexicanus *De Saussure.*

*Macrotus mexicanus* DE SAUSSURE, Rev. et Mag. de Zool., 2e Sér., XII, 1860, p. 486.

*? Macrotus bocourtianus* DOBSON, Ann. & Mag. Nat. Hist., 4th Ser., XVIII, 1876, p. 436; Cat. Chirop., 1878, p. 467.

Eight skins with skulls, eight additional skulls, and six specimens in alcohol, Tehuantepec City, Jan. 27, 1890.

This series of fourteen specimens differs strikingly in respect to coloration from the series of thirteen specimens from Bolaños and Guadalajara, State of Jalisco, but not appreciably in any other external feature. In both forms the basal half or two-thirds of the fur of the dorsal surface is pure white passing gradually into the darker color of the terminal portion, with the extreme tips of the hairs grayish. In *bulleri* the terminal third or more of the fur is dark plumbeous, varying from dark clove brown to plumbeous black; in *mexicanus* it is dark brown, varying from pale cinnamon to dusky chestnut. The same tints prevail respec-

tively below in the two forms, where, however, the basal white zone is more restricted, the dark subterminal portion is less deeply colored, and the gray tips of the hairs are longer. In *bulleri* the ears and wing-membranes are blackish; in *mexicanus* they are brown. The difference in the general coloration of the two forms is thus very striking, with no tendency to intergradations, so far as the material in hand is concerned.

A comparison of the skulls shows well-marked cranial differences between the two forms, the skull in *M. mexicanus* being much the larger, with the rostral portion much broader, and quite different in general contour.

The type of De Saussure's *M. mexicanus* came from Yautepec, in the *tierra caliente* south of the City of Mexico, and hence from a region physiographically very different from that inhabited by *M. bulleri.* His description appears to agree perfectly with the Tehuantepec specimens above referred to *M. mexicanus.*

*M. mexicanus*, *M. bulleri*, and *M. waterhousii* (*M. californicus* is not at hand for comparison), differ very markedly from each other in coloration, but only slightly in size or other external features. The ears appear rather larger in both *M. waterhousii* and *M. bulleri* than in *M. mexicanus.* *M. waterhousii* seems also to be slightly the largest of the three forms, and *M. bulleri* the smallest, the length of the forearm varying as follows: *M. bulleri*, 42 to 48 mm., averaging 45; *M. mexicanus*, 48 to 53, averaging 51; *M. waterhousii*, 51 to 53, averaging 52. In coloration *M. bulleri* is much the darkest and *M. mexicanus* the lightest and most rufescent, especially below. *M. waterhousii* is intermediate, being darker and less rufescent than *M. mexicanus*, but not nearly so dark above as *M. bulleri*, though of about the same tint below. *M. waterhousii*, however, differs from both the others in having the posterior third of the dorsal surface lighter and of a decided yellowish brown, in contrast with the sooty grayish brown of the rest of the dorsal surface, while in the others the whole dorsal region is concolor.

The length of the free portion of the tail varies in all; while generally only the last caudal vertebra is wholly free, not unfrequently half or more of the autepenultimate is also free. This is notably the case in both *M. waterhousii* and *M. mexicanus.* It

hence seems not improbable that *M. boucourtianus*, from Vera Paz, based mainly on this last feature, may be referable to *M. mexicanus*.

**22. Sturnira lilium** (*E. Geoffr.*). — One specimen, Sierra Nevada de Colima, Jalisco, Dec. 6, 1889.

This is apparently the first record for this species from any point north of Honduras and Costa Rica.

### 23. Artibeus carpolegus *Gosse* (?).

*Artibeus jamaicensis* De Saussure, Rev. et Mag. de Zool., 1860, p. 438.

*Artibeus perspicillatus* Alston, Biol. Centr.-Am., Mam., 1879, p. 47 (Mexican and Central American references).

Two specimens, male adult in alcohol, and female adult, skin, Santo Domingo, Tehuantepec, May, 1890. (For remarks on these specimens see this Bulletin, *antea*, pp. 170–172.)

### 24. Sciurus aureogaster *Cuv.*

*Sciurus aureogaster* F. Cuvier, Hist. des Mam., III, liv. lix, 1829; Allen, N. Am. Roden., 1877, p. 700; Bull. U. S. Geol. Surv., IV, 1878, p. 882 (in part).

*Sciurus variegatus* Alston, P. Z. S., 1878, 660 (in part—the "*aureogaster* type" only); Biol. Centr.-Am., Mam., 1880, p. 127 (in part, not the figure, pl. xi).

Two skins with skulls and one additional skull, Sarabia, Tehuantepec, Mexico, April 19, 1890.

These are very red examples of this form, the whole ventral surface being not only deep orange red, but the same color extends high up on the sides of the body and across the shoulders, so as to occupy the whole thoracic region from the nape to beyond the scapulæ, and including also both fore and hind limbs, except the feet, which are dark gray more or less mixed with dark red. The rest of the dorsal surface is varied with dark rufous, black, and white, the hairs being tipped with white, then ringed narrowly with black, and then broadly banded with deep chestnut red.

In Mr. Sennett's six specimens from near Tampico, to which I have previously referred (Bull. Am. Mus., II, p. 166), the hairs of the dorsal surface are much more broadly tipped with white, and the red of the ventral surface, while extending far up over the shoulders and covering the fore limbs, scarcely reaches the median dorsal line. It is worthy of note that Mr. Sennett's

specimens were taken in May, and that among them is a suckling, apparently only a few days old, which has the same pattern of coloration and about the same tints as the adults. These specimens of course represent the summer or breeding pelage.

### 25 Sciurus leucops (*Gray*).

*Sciurus aureogaster* GEOFFROY, Voyage de la Venus, Zool., 1855, p. 156, pll. x, xi (not *S. aureogaster* F. Cuvier, 1829).

*Macroxus leucops* GRAY, Ann. and Mag. Nat. Hist., 3d Ser., XX, 1867, p. 427.

*Sciurus leucops* ALLEN, N. Am. Roden., 1877, p. 753.

*Sciurus variegatus* ALSTON, P. Z. S., 1878, p. 660; Biol. Centr.-Am., Mam., 1880, p. 127, pl. xi (the "*leucops* type" only).

Six skins and skulls, Tehuantepec City, State of Oaxaca, Feb. 3 to March 9, 1890.

These specimens appear to typically represent the *Macroxus leucops* of Gray, described from "Oaxaca." The material now before me, taken in connection with that previously examined, leads me to resume the position I took in 1877 (N. Am. Roden., pp. 750–756) regarding the status of the forms then recognized as *S. aureogaster* and *S. leucops*, from which I have since wavered,* in deference to Mr. Alston's conclusions.† The pattern of coloration in the two forms is very different, in *leucops* there being always a well-defined nuchal patch of rufous, and generally another rufous area on the rump, the latter, however, sometimes absent. While the color of the ventral surface may vary from pure white, through buff and pale yellow to golden and even orange rufous, it does not extend up the sides of the body at the shoulders, nor encroach upon the outer surface of the limbs, as in *aureogaster*, the line separating the colors of the dorsal and ventral surfaces being a straight line at the usual point in other mammals having the two surfaces differently colored. The skull, while of nearly the same size in the two forms, is much heavier and stronger in *aureogaster*, with the first premolar much larger and the dentition much heavier.

The six specimens from Tehuantepec City vary considerably in color above, and greatly in the color of the ventral surface. All have a large fluffy conspicuous white patch behind the ear (possibly disappearing later in the season). The nuchal patch is

* Bull. U. S. Geol. Surv., IV, 1878, p. 882.

† P. Z. S., 1878, pp. 660–662.

strongly developed (about two inches long and nearly as broad), varying in color, however, from rather pale rufous mixed with gray to deep clear ferrugineous. The rump patch is less strongly colored, less clearly defined, and in two specimens is quite obsolete. The ventral surface in two specimens is grayish white; in a third faintly washed with buff; in a fourth deep yellowish buff; in a fifth orange rufous, and in the sixth deep orange rufous.

### 26. **Sciurus cervicalis,** sp. nov.

*Sciurus aureogaster leucops* ALLEN, Bull. Am. Mus. Nat. Hist., II, Art. XVI, Oct. 21, 1889, p. 166 (excluding synonyms).

Eight specimens, as follows: Sierra Nevada de Colima, Jalisco, Dec. 1–11, 1889, six specimens; Hacienda San Marcos, Volcan de Fuego, Tonila, Jalisco, Dec. 30, 1889, one specimen; Plains of Colima, Jan. 10, 1890, one specimen. These with four previously received and reported upon (l. c.) form a series of 12 specimens, collected during the months of December, January, April, and May. The series is remarkably uniform as regards coloration, in this respect May and December specimens being indistinguishable, while the range of individual variation is astonishingly narrow, and is covered by the remarks on the four specimens in my former paper on Mexican Mammals (l. c.).

In comparing the first four examples with a series of Tampico specimens of *S. aureogaster* I said, "it seems hardly possible that the two forms should be considered as conspecific, the style of coloration being so radically different.... In view, however, of former experience in respect to the variability of Mexican Squirrels, especially in color, it seems probable that Mr. Alston's view that the *S. leucops* is only a form of *S. aureogaster* Cuv., occupying a distinct habitat of its own, is correct."

I then reluctantly identified this form with *S. leucops*, under the name *S. aureogaster leucops*, noting, however, that it differed from any *leucops* specimens I had previously examined. I have since (thanks to Mr. Buller's excellent work) received specimens of true *leucops* from near the type locality, and also additional specimens of *aureogaster*. This new material shows that not only are *leucops* and *aureogaster* very distinct forms, each with its own habitat, but that the specimens from Jalisco then referred to *leucops* repre-

sent still another form very different from either. This may be characterized under the name above given, as follows :

Top of head black, generally varied more or less with gray, through the gray tipping of some of the hairs; general color above dark gray, the hairs plumbeous at base, subterminally broadly ringed with black and narrowly tipped with white ; a broad nuchal patch, extending generally from the hinder portion of the crown to the shoulders, and more or less on to the sides of the neck, yellowish rufous varied with black, the hairs here being tipped with rusty instead of white ; a very broad area of the same color as the nuchal patch covers the lower back and rump, extending from a point opposite the hips to the base of the tail, and across from one hip to the other. (These patches vary somewhat in size and in the tone of the rufous, which varies from yellowish rusty to brownish rusty. In one specimen these patches are quite pale, and in another nearly obsolete, but in the other ten are conspicuously developed.) Below pure white, in summer pelage (May specimens) the hairs being pure white to the base, in winter specimens with the basal portion ashy. The tail, both above and below, is black, washed heavily with white, the hairs of the upper surface being generally wholly black from near the tip to the base, with a long white tip, those of the lower surface white at the extreme base, then narrowly ringed with black, followed by a narrow band of white, and this with a broad band of black and a long white tip. Feet varying from nearly pure white to grayish white ; ears gray varying to blackish, generally more or less tinged with rusty, with a white woolly patch at the posterior inner base, well developed in winter specimens.

*Measurements.*—Head and body, 250 mm. ; tail, 330 ; total length, 550–600 mm. (collector's measurements). Hind foot, 60–63 ; height of ear from crown, 18–20 (from skin).

Type, No. 1991, Hacienda San Marcos, Tonila, Jalisco, ♂ ad., May 14, 1889.

Summer and winter specimens appear to differ only in the pelage in winter being longer and softer than in summer, the fluffy white post-auricular patches better developed, and in the white of the ventral surface being somewhat grayish, from the basal portion of the pelage being ashy.

While both *S. leucops* and *S. cervicalis* have generally distinct rufous nuchal and rump patches, they are very different in the two forms, not only in color but in the position occupied by the rufous portion of the hairs composing these patches. In *S. cervicalis* the rusty tint is restricted to the tips of the hairs, and simply replaces the gray tipping of the hairs on the rest of the dorsal surface ; in *S. leucops* the tips of the hairs of the rump patch are gray, the rufous occupying the subterminal instead of the terminal color zone of the hairs, while in the nuchal patch the rufous occupies all but the extreme base of the hairs. In other words the subterminal color zone in *cervicalis* is black ; in *leucops* rufous.

Furthermore, in *cervicalis* the only rufous tint present is the tipping of the hairs of the nuchal and rump patches, while in *leucops* it more or less deeply suffuses the whole sub-apical portion of the dorsal pelage.

*S. cervicalis* ranges from the Plains of Colima (to which, according to Dr. Buller, it migrates in winter) up to the summits of the neighboring Sierras, some of the specimens being labeled as taken at an altitude of 12,000 feet, while *S. leucops* and *S. aureogaster* both come only from the *tierras calientes* of eastern and southeastern Mexico. These two occur together, however, in the neighborhood of Tehuantepec, as shown not only by the present collection, but by material which passed through my hands in 1876. Then, as now, I considered them distinct species.

Probably *S. cervicalis* has, like the next species, a rather restricted distribution, the specimens received from Dr. Buller being all from the mountains of Colima, except one taken in January, on the plains at the base of the Sierra.

### 27. Sciurus nayaritensis *Allen.*

*Sciurus alstoni* ALLEN, Bull. Am. Mus. Nat. Hist., II, No. 3, Art. XVI, Oct. 21, 1889, p. 167 (not *S. alstoni* Anderson, 1878).

*Sciurus nayaritensis* ALLEN, Bull. Am. Mus. Nat. Hist., II, No. 4, Feb. 1890. p. vii.

No specimens have been received since those already described (l. c.). Attention, however, should be called to the change of name, published Feb., 1890, in "Additions and Corrections" to Volume II of this Bulletin, that originally given proving to be preoccupied.

**28. Spermophilus grammurus macrourus** (*Bennett*). — Three specimens, male and female adult, and a young (half-grown) female, Zapotlan, Jalisco, Dec. 13, 17, and 23, 1889. (See also this Bulletin, II, p. 170.) These scarcely differ from the four April specimens previously recorded, although taken at the opposite season of the year. They bear out all that was claimed for this subspecies in my former paper.

**29. Spermophilus spilosoma** *Bennett.* — Two specimens, Zacatecas. (See this Bulletin, II, p. 172.)

**30. Spermophilus annulatus** *Aud. & Bach.*—In addition to the single specimen recorded in my former paper (this Bulletin, II, p. 172), Dr. Buller has sent eight others, two males and six females, and three additional skulls, collected at the Hacienda Nogueras, Colima, Nov. 13–15, 1889.

Dr. Buller adds to his former notes as follows: "Local name, *Tesmo.* Said not to occur above Ranch 'El Trapiche,' on road between Colima and Tonila. Below Colima ranges to the base of coast range, to where sand commences. Lives in holes in sides of dykes. Also in stone walls and walls of barns, in the vicinity of habitations. Food, maize, and seeds of Pasta Christi."

The extremes of the series vary somewhat in depth of color, the light tipping of the hairs of the dorsal surface varying from buff to yellowish rufous, with corresponding differences in the intensity of color of the sides of the neck, limbs, and ventral surface.

### 31. Tamias bulleri *Allen.*

*Tamias asiaticus bulleri* ALLEN, Bull. Am. Mus. Nat. Hist., II, No. 3, Art. XVI, Oct. 21, 1889, p. 173.

*Tamias bulleri* ALLEN, *ibid.*, III, No. 1, Art. IV, June, 1890, p. 92.

Eight specimens, Sierra de Valparaiso, Zacatecas (see this Bulletin as cited above). The later collections contain no additional specimens.

**32. Mus rattus** *Linn.*—Two adult males, Zapotlan, Jalisco, Dec. 17 and 21, 1889. (See also this Bulletin, II, p. 179.)

**33. Mus alexandrinus** *E. Geoffr.*—One adult male, Zapotlan, Jalisco, Dec. 20, 1889.

**34. Mus musculus** *Linn.* — Four specimens, Tehuantepec City, Feb. 12 and May 12, 1889.

**35. Neotoma ferruginea** *Tomes.* — Four specimens: three females, Tehuantepec City, Feb. 27 and 28; one male, Santo Domingo, Tehuantepec, April 25, 1890.

### 36. Sigmodon hispidus berlanderi (*Baird*).

*Hesperomys* (*Deilemys*) *toltecus* DE SAUSSURE, Rev. et Mag. de Zool., 2e Ser., XII, 1860, p. 98.

Four specimens, Colima Plains, Jan. 5–11, 1890; one specimen, Santo Domingo, Tehuantepec, May 1, 1890.

These specimens seem to be indistinguishable from De Saussure's types of his *Hesperomys toltecus*, from the "Cordilière de la province de Véra Cruz," which, through the kindness of Dr. C. Hart Merriam, I have had an opportunity to examine.

**37. Sigmodon fulviventer** *Allen.*—One specimen, Zacatecas. (See this Bulletin, II, p. 180.)

**38. Hesperomys leucopus sonoriensis** (*Le Conte*).—See this Bulletin, II, p. 180.

**39. Hesperomys aztecus** *De Saussure.* — Two specimens, Jalisco. (See this Bulletin, II, p. 179.)

A comparison of these two specimens (shown by the skulls to be not fully mature) with two of De Saussure's three original specimens of this species, shows their former reference to *H. aztecus* to have been correctly made. They are a little smaller than De Saussure's specimens, but agree with them almost exactly in color and in all external details.

### 40. Hesperomys melanophrys *Coues.*

*Hesperomys mexicanus* ALLEN, Bull. Am. Mus. Nat. Hist., II, p. 179 (not *H. mexicanus* De Saussure).

The single specimen, from Zacatecas, formerly reported (l. c.), has since been compared with De Saussure's type of *H. mexicanus* and found to be very different. On the other hand, it agrees well with the type of Coues's *H. melanophrys*, to which species it is now referred. *H. mexicanus* and *H. melanophrys* prove on comparison to be very different species.

**41. Hesperomys (Nyctomys) sumichrasti** *De Sauss.*—Five specimens, three adult males, one adult female, and one immature female, Santo Domingo, Tehuantepec, April 24 to May 1, 1890. The young specimen differs from the adults in being yellowish ashy above instead of golden cinnamon.

These specimens have been compared with De Saussure's types (see above, p. 175), with which they strictly agree.

**42. Oryzomys couesi** (*Alston*).—One specimen, adult male, Hacienda San Marcos, Tonila, Jalisco, Dec. 30, 1889.

## 43. **Lepus sylvaticus aztecus,** subsp. nov.

Smaller than *L. sylvaticus* of the Eastern States, with much longer ears (in this respect resembling *L. arizonæ*), and lighter in coloration.

Length (measurements from skins) of head and body, 300 mm.; tail to end of hairs, 37; length of hind foot, 82; height of ear from notch, 64.

Top of head and middle of back buffy cinnamon varied with black, the hairs light plumbeous at base, subterminally ringed with pale buffy cinnamon and tipped with black; sides gray, the hairs ashy at base, broadly ringed with white and tipped with black; sides of neck brownish, nearly like the middle of the back; large nape spot and outer surface of limbs bright yellowish rufous; upper surface of fore feet yellowish white, of hind feet pure white, which extends upward in a narrow band along the inner anterior edge of the leg to the inner side of the thigh; lower surface pure white, nearly to the base of the hairs; breast band yellowish white, the hairs brownish beneath the surface; a well defined supra- and subocular grayish white stripe, meeting in front and behind the eye, giving the effect of a broad grayish white band through the eye, from near the nose to the base of the ear; cheeks gray, with a small spot of rusty brown below the eye; upper surface of the tail light cinnamon rufous, the same color extending forward on to the rump, the hairs plumbeous (in some specimens dusky plumbeous) at the base broadly tipped with light rufous. Ears very large, scantily haired, dark brownish gray, darkening to blackish towards the tip and along the anterior border externally; anterior border towards the base fringed externally with white.

*Cranial Characters.*—Skull, basilar length, 56 mm.; total length, 72; breadth at middle of zygomatic arch, 35; at base of occiput, 23, at postorbital constriction, 12; nasals, length, 33, breadth at anterior border, 10, at posterior border, 17; length of malar bone, 31; length of upper molar series along the crowns, 12, at alveolar border, 14; lower jaw, length from front to angle, 53, height at condyle, 36.

The posterior end of the postorbital process is in contact with the brain-case, but not fused with it. In general features the skull is similar to that of *L. sylvaticus*, differing from it merely in being rather smaller than average northern skulls.

Type, $\frac{3116}{2438}$, ♂ ad., Tehuantepec City, Feb. 19, 1890.

Three adult males, skins and skulls, and one additional skull, as follows: Salina Cruz, Feb. 17, Sta. Maria Petapa, April 29, Santo Domingo, April 30, 1890, Isthmus of Tehuantepec; Tehuantepec City, Feb. 19, 1890.

This form differs from *L. sylvaticus* in having the middle of the dorsal surface much paler, the sides grayer, and the upper surface of tail and rump cinnamon rufous instead of dusky gray, and in the very much larger size of the ears. In respect to the size of the ears it closely resembles *L. arizonæ*, but differs from it in much larger size, and greatly in coloration, through the almost entire absence in the latter of any rufous in the coloration of the upper surface.

## 44. **Lepus insolitus,** sp. nov.

Similar in general appearance externally to *Lepus sylvaticus*, but much paler in color, much larger, and with much larger ears, but especially different in the structure of the malar bone, which is exceptional in its character. Also generally similar in size and color to *L. veræ-crucis* Thomas, recently described from Vera Cruz, but apparently different.

Length (of skin), 440 mm. ; tail to end of hairs, 40 ; hind foot to end of claws, 92 ; height of ear from notch, 74, above crown, 78.

Above sandy buff mixed with black, more grayish on the sides, black prevailing over most of the dorsal region, hairs at base dark plumbeous, ringed with black, then with sandy buff, and tipped with black ; nape patch and fore limbs externally from shoulder to carpus deep rufous ; upper surface of fore feet brownish yellow ; hind limbs posteriorly and externally yellowish brown ; upper surface of hind feet white, continuous with a whitish band running up the front inner edge of the leg ; light area surrounding the eye buffy gray ; upper surface of tail and contiguous portion of rump pale rusty brown, the hairs plumbeous at extreme base and slightly black tipped ; ears sparsely haired, externally rusty brownish gray, blackish along the edge towards and at the tip ; internally ears naked to near the tip, where they are sparsely covered with yellowish brown hairs for the terminal fifth ; ventral surface pure white, the hairs wholly clear white to the base ; a faint wash of yellowish along the sides bordering the white ventral area ; breast pale yellowish brown, plumbeous beneath the surface. Feet not heavily furred.

Skull, basilar length, 66 mm. ; total length, 83 ; greatest width (opposite anterior end of orbital foramen), 39 ; interorbital breadth, 21 ; intertemporal breadth, 20.5 ; nasals, length, 34, width anteriorly, 12, posteriorly, 18.5 ; length of malar bone, 36 ; length of palatine foramen, 21 ; least length of palatal bridge, 8, width, 11.5 ; length of upper molar series at crown surface, 22.5 ; length of lower jaw, 58 ; height at condyle, 40.

Type, $\frac{2655}{2133}$, ♂ ad., Plains of Colima, Jan. 15, 1890.

A second specimen (♀ ad., near City of Colima, Jan. 7, 1890), agrees essentially in size, but is in thin, very worn pelage, and is less black above, doubtless owing to the wearing away of the long black tips of the hairs.

While in a general way strongly resembling externally both *L. sylvaticus* and *L. veræ-crucis*, it differs from the former in much larger size, disproportionately larger ears, the less amount of rufous and greater prevalence of black above ; and from the latter in the whiteness of the ventral surface, and in other minor details of coloration. It differs from all of the species of *Lepus* known to me in the peculiar structure of the malar bone, which is formed on the general pattern of that of *Lepus aquaticus*, with, however, its peculiarities greatly exaggerated. Externally for its anterior

half both the upper and lower borders are greatly produced, especially the lower, which is somewhat everted or deflected upward and incurved, the two produced borders thus forming between them a deep groove on the external surface of the anterior half of the malar bone, the groove being deepest anteriorly and there partly covered by the incurved lower edge of the malar. The square process occupying the anterior fourth of the malar in the *L. sylvaticus* group is in effect extended backward, gradually narrowing till it becomes obsolete posterior to the middle of the malar bone. The form of this bone is thus very different in the two species when viewed either from below or from the side. The postorbital processes touch the brain-case at tip but are not fused with it, as in the *L. aquaticus* group.

In accordance with the great development of the external ear, the auditory bullæ are correspondingly enlarged.

The only species with which this needs comparison is apparently the *Lepus veræ-crucis*, from the opposite coast of Mexico.

**45. Tatusia novemcincta** (*Linn.*).—Male, Volcan de Fuego, Tonila, Jalisco, Dec. 27, 1889.

**46. Didelphys (Micoureus) murina** *Linn.*—Six specimens, four males and two females, Santo Domingo de Guzman, Tehuantepec, April 25 to May 2, 1890.

These specimens are doubtfully referred to this species, which they resemble in size. None of them, however, have the general color above "bright rufous," or "deep dull rufous," as described respectively by Alston and Thomas. Some are clear ashy, others ashy brown, with a very faint fulvous or exceedingly slight rufescent tinge.

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**Additional Notes on Mexican Leporidæ.**—Since the above was put in type I have had opportunity, through the kindness of Mr. F. W. True, Curator of the Department of Mammals in the United States National Museum, of reëxamining specimens of *Lepus* from Merida, Yucatan, and Mirador, Mexico, referred by me in 1877 (N. Am. Roden., pp. 365 and 361) respectively to *Lepus aquaticus* and *L. palustris*.

### **Lepus sylvaticus aztecus** *Allen.*

Five adult and two young specimens of *Lepus*, belonging to the U. S. National Museum, from Merida, Yucatan, collected by Dr. A. Schott in February and March, 1865, were formerly referred by me (N. Am. Roden., pp. 365–367) to *Lepus aquaticus*. Three of these specimens are now before me, and while externally much resembling *L. aquaticus*, a skull, now for the first time removed from one of the skins for examination, shows that they are not *L. aquaticus* but referable to my *L. sylvaticus aztecus*, described on page 188 of the present paper, with which these specimens are found to agree in both external and cranial characters. The skins were badly prepared and somewhat overstuffed, and without recourse to the skull might readily be mistaken for *L. aquaticus*, the coloration being nearly the same, and the feet very scantily furred for a member of the *L. sylvaticus* group. Other specimens collected at Mirador, by Dr. Schott, and forming part of the same collection, were referred by me to *L. sylvaticus*, as were specimens from Tehuantepec, collected by Mr. F. Sumichrast (l. c., pp. 330 and 336). The latter series included a number of skulls, which served for the ready identification of the Tehuantepec series. Although these specimens are not now accessible for reëxamination, I have little doubt of their being referable to the form here recognized as *L. sylvaticus aztecus*. A part of the Orizaba specimens are referable to the following species :

### **Lepus veræ-crucis** *Thomas.*

*Lepus veræ-crucis* THOMAS, P. Z. S., 1890, p. 74, pl. vii.

*Lepus aquaticus* ALLEN, N. Am. Roden., 1877, p. 364 (in part, Orizaba specimens only).—ALSTON, Biol. Centr.-Am., Mam., p. 180 (Dec. 1880), in part, or so far as based on the preceding.

A reëxamination of the Orizaba specimens referred by me in 1877 (l. c.) to *L. aquaticus* shows, on removal of the skull from the skin, that they belong to the *L. sylvaticus* type instead of to *L. aquaticus*. I have little doubt that they are identical with what Mr. Oldfield Thomas has recently described as *Lepus veræ-crucis*, based on specimens from Las Vigas, Jalapa, a locality not far from Orizaba. In general size and in external characters it closely resembles my *L. insolitus*, described above, but the skull

is very much broader, and the form of the malar bone very different. Both species somewhat resemble *L. aquaticus* externally, but are readily separable from it and from each other by the cranial characters.

### **Lepus truei,** sp. nov.

? *Lepus palustris* TOMES, P. Z. S., 1861, p. 281 (Dueñas, Guatemala).

*Lepus palustris* ALLEN, N. Am. Roden., 1887, p. 360 (in part, the Mirador specimen only).—ALSTON, Biol. Centr.-Am., Mam., p. 179 (Dec. 1880), so far only as based on the above.

In 1877 a single specimen of *Lepus* from Mirador was referred by me (l. c.) to *Lepus palustris.* This was the only specimen thus referred, or then known to me, from any point outside of South Carolina and Georgia. Florida has since been added to its known range, but it has not yet been found at any point in the Gulf States west of Florida, where considerable collecting has since been done. Hence the single record from so remote a point as Mirador, Mexico, has of late seemed open to serious question. I am hence much gratified to be able to revise the record by a reëxamination of the Mirador specimen. It is in poor condition, but is still available for study. The skull having just now been removed by my request, it proves to represent a very distinct type of the genus, so far as cranial characters are concerned. Externally it so much resembles *L. palustris*, that on seeing it again after a long interval the question arose as to whether its alleged Mirador origin might not have resulted from a transposition of labels. As soon, however, as the skull became available it was evident that the resemblance of the Mirador specimen to *L. palustris* was wholly superficial, and limited to external characters. It differs, however, somewhat from *L. palustris* in coloration, as stated in my former reference to it, as follows: "By far the most highly-colored specimens is one from Mirador (near Vera Cruz), Mexico, in which the black is considerably more prevalent than in average specimens from the Atlantic States. The grayish area below is also more restricted and more suffused with brownish." Mr. Alston quotes this (l. c.), and adds: "The same remarks apply to an example contained in Mr. Salvin's Guatemalan collections in the British Museum," the specimen here referred to being the one mentioned by Tomes (l. c.), from

Dueñas. These two specimens are apparently all thus far referred to *L. palustris* from Mexico or Central America, or from any point outside of the lowlands of the coast region of South Carolina and Georgia, and the peninsula of Florida.

In now describing this new form, it gives me pleasure to name it in honor of the Curator of Mammals at the U. S. National Museum, to whose kind offices I have been many times indebted.

Similar to *L. palustris* in all external characters, except that it is rather darker in color, and much more varied with black above, which is almost the prevailing tint over much of the dorsal region. Feet quite as scantily furred as in *L. palustris*. The skin is unfilled, and hence satisfactory measurements cannot be taken. (The feet have been partially denuded by insects.) It is evidently smaller than average full grown specimens of *L. palustris*. Length of hind foot, 75 mm. ; of fore foot, 40 ; height of ear from crown, 54 ; from notch, 46.

*Cranial Characters.*—The skull is imperfect, lacking most of the occipital portions. It shows the animal to have been fully adult. In dorsal outline it much resembles skulls of *L. sylvaticus aztecus*, except that the cranial portion is more depressed posteriorly ; the frontal and parietal bones much pitted, as in *L. palustris* and *L. aquaticus*. The postorbital processes are slender, and barely touch the cranium posteriorly, thus enclosing a large broadly oval foramen. The zygoma is broad and short, flattened below anteriorly and not much expanded, with the sinus on the lateral face anteriorly about as in *L. sylvaticus*. The zygomatic and mastoid portions are vertically much expanded, the zygoma being thus much shorter and relatively much broader than in any of the allied forms ; with a length of 28 mm. the vertical breadth is 4.5, against 30 and 4 respectively in *L. sylvaticus aztecus*, and 34 and 3.5 in *L. palustris* of corresponding general size. The teeth are broad, the middle upper molars having a transverse breadth at the crown surface of 4 mm. against a total length of the upper molar series of 12. The palatal region is very broad (distance between inner base of middle molars 12.5), with a very short palatal bridge (6 mm.) ; there is a slender spiny process on the anterior border, with, however, no trace of any on the posterior border. The palatal walls are widely separated, forming a broad U-shaped arch instead of the narrower and more sharply V-shaped arch of *L. palustris* and other allied forms. The basisphenoid stands at about the usual angle with the axis of the skull, and the basioccipital lies in the same plane, instead of forming, as in allied species, an obtuse angle with the basisphenoid. The nasal bones are much flattened and much less than half as much arched in front as in any allied form. The posterior half of the brain-case is very abruptly depressed, in conformity to the depressed plane of the basioccipital below. The middle portion of the skull is very broad in comparison with the width of the brain-case, or with the total length of the skull.

The following are the principal measurements : Basilar length, 57 mm. ; total length (?) ; greatest breadth (at zygomatic arch), 35 ; least interorbital breadth,

25 ; palatal breadth at middle of palatal bridge, 11 ; length of nasals, 27 ; width of nasals posteriorly, 14 ; width at anterior border, 10 ; length of zygoma, 28 ; length of upper molar series at alveolar border, 14 ; length of lower jaw (?) ; height at coronoid process, 32.

Type, $\frac{6357}{25953}$, U. S. Nat. Mus., Mirador, Mexico ; C. Sartorius.

It hence appears that thus far no authentic specimens of either *L. palustris* or *L. aquaticus* are known from Mexico, the habitat of the former being, so far as now known, Florida and the coast region of Georgia and the Carolinas, and of the latter, the Gulf coast of the United States, from western Alabama to Texas, and thence northward in the cane-brake region to southern Illinois. Their introduction into the list of Mexican mammals, so far as the present writer is concerned, is due to the fact that the skulls of the Mexican specimens referred to these species were not removed from the skins for examination, the determinations being based on external characters, which proved very misleading.

ARTICLE XII.—*Description of a New Species of Big-eared Bat, of the Genus Histiotus, from Southern California.* By J. A. ALLEN.

The finding of a Big-eared Bat, of the South American genus *Histiotus* Gerv., in Southern California, is a most unlooked for occurrence, exceeding possibly in interest the recent discovery in the same region of a species of *Molossus*, allied to *M. perotis* of Brazil, by Dr. Merriam.*

The specimen on which the present description is based was "caught on a fence," at Piru, in the western part of Ventura County, California, in March, 1890, by Mr. Thomas Shooter. I am indebted to the kind offices of Mr. E. C. Thurber, of Alhambra, California, for the specimen, through whom it was secured for the American Museum of Natural History.

On attempting to remove the skull from the skin, the specimen proved to be mummified, having been simply eviscerated and allowed to dry. By careful treatment it yielded not only a good skin, but the greater part of the skeleton and skull. Unfortunately the sex of the specimen could not be determined, owing to mutilation in the process of evisceration. The skull and dentition show it to have been a rather young though doubtless full-grown individual.

## **Histiotus maculatus,** sp. nov.

Ears joined at the base, foliaceous, very large, twice as long as the head, about one-half as broad as long, well fringed with whitish hairs along the inner border, but elsewhere naked; expanse from tip to tip, 76.2 mm. (3.00 in.). The ears are convex on the inner border, broadly rounded at the tip; outer border convex on the basal half, slightly hollowed toward the tip. The inner border near the base forms an obtuse angle; the outer border is continued as a low fold to a point below the angle of the mouth. The tragus expands abruptly on the outer border at the end of the basal fourth, at which point it also has an abrupt lateral deflection, the inner border forming an obtuse angle about opposite the beginning of the basal third. The upper three-fourths of the tragus is straight on the inner border, convex on the outer, and very obtusely rounded at the top. Nostrils prominent, at the end of a narrow, low, naked disk, divided by a slight groove, and narrowing posteriorly to a point. Rest of the face well

* Description of a New Species of Molossus from California (*Molossus californicus*). By Dr. C. Hart Merriam. North American Fauna, No. 4, Oct. 8, 1890, p. 31.

haired, blackish, apparently (judging from the dry skin) without warts or tubercles. Thumbs with a small basal pad. Toes thinly haired. Wing membranes from the base of the toes, pale brown, everywhere wholly without fur. About half of the last caudal vertebra free.

Pelage long, full, and soft. Whole dorsal surface deep black, the fur uniform from the surface to the base, except on the rump, and a large patch on each shoulder, where the apical half of the fur is *pure white*, the basal portion being black. The white rump patch has a length of about three-fourths of an inch, by a width of half an inch. The shoulder patches are symmetrical in form and position, being directed obliquely backward and inward, about half an inch wide by nearly an inch in length. The black of the dorsal surface extends downward on the sides of the neck in front of the shoulders, forming a broad lunate patch on each side. Posterior base of the ears, the whole throat and sides of fore neck to the ears, pure white, the fur dusky at the base. Rest of the lower surface with long white tips to the hairs, which over the breast are so long as to wholly conceal the dusky underfur.

*Measurements.*—Length of head and body, 62 mm. (2.45 in.); tail, 49.5 mm. (1.95 in.); length of ear, 38.1 mm. (1.50 in.), width across the middle, 27.9 mm. (1.10 in.); height of tragus, 12.7 mm. (.50 in.), breadth at middle, 5.6 mm. (.22 in.); humerus, 29.7 mm. (1.17 in.); fore arm, 50.8 mm. (2.00 in.); thumb, 6.9 mm. (.27 in.); third finger: metacarpal, 49.3 mm. (1.94 in.), 1st phal., 15.75 mm. (.62 in.), 2d phal., 27.9 mm. (1.10 in.)=95.5 mm. (3.76 in.); fourth finger: metacarpal, 46.2 mm. (1.82 in.), 1st phal., 14 mm. (.55 in.), 2d phal., 16 mm. (.63 in.)=76.2 mm. (3.00 in.); fifth finger: metacarpal, 45.7 mm. (1.80 in.), 1st phal., 11.4 mm. (.45 in.), 2d phal., 10.2 mm. (.40 in.)=67.3 mm. (2.65 in.); femur, 43.7 mm. (1.72 in.); tibia, 22.9 mm. (.90 in.); hind foot, 7.6 mm. (.30 in.).

*Skull and Dentition.*—Basilar length, 16.5 mm. (.65 in.); total length, 19 mm. (.75 in.); zygomatic width, 10.9 mm. (.43 in.); height, 7.6 mm. (.30 in.); length of lower jaw, 12.7 mm. (.50 in.); height at condyle, 33 mm. (.13 in.); height at coronoid process, 3.8 mm. (.15 in.); length of upper tooth row, 6.86 mm. (.27 in.); length of lower tooth row, 7.6 mm. (.30 in.). Dental formula: incisors, $\frac{2-2}{6}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{1-1}{2-2}$; molars, $\frac{3-3}{3-3}=\frac{14}{18}=32$.

The skull is thin and papery, being evidently that of a young animal. The facial portion is narrow and pointed; the brain case is quadrate, flattened above, but rises abruptly at the frontal border, the forehead being suddenly depressed.

The lower border of the zygomatic arch is curved upward; the upper border is greatly expanded vertically, the upper border of the malar forming a high angular process at the middle of arch; the zygomatic process of the squamosal is short, and, with the malar, passes forward in a line nearly parallel with the axis of the skull, with only a very slight outward cuvature. The tympanic bullæ are enormously expanded, having an antero-posterior length of 5.84 mm. (.23 in.) and a transverse breadth of 3.3 mm. (.13 in.), their length fully equaling one-third of the length of the skull. In other respects the ventral aspect of the skull

presents nothing peculiar. The lower jaw is narrow, the coronoid process small, rising but little above the condyle; the angle is well developed.

The dentition is weak, the incisors and canines being very small, relatively to the molar series. The outer upper incisor is about one-half the size of the inner; both have a small outer cusp at the base. The upper canine is about equal in size to the anterior half of the upper premolar. The molars present nothing distinctive. The lower incisors are slightly double-notched (trifid); the lower canines are very small; the first premolar is about half the size of the second.

The present species appears to bear a general resemblance to *Histiotus velatus* and *H. macrotus* of Brazil and Chili, as regards general size and the form and size of the ears. It is, however, larger than either, with the ears relatively as large as in *H. macrotus*, and differs from both in the form of the tragus, which instead of being narrowed apically and subacutely pointed, is broad towards the tip and obtusely rounded. In *H. macrotus*, according to Dr. Peters,* the outer upper incisor is minute as compared with the inner, while in the present species the upper incisors are comparatively subequal. There is also a striking difference in coloration, the present species being particolored, black and white, the others yellowish brown above and whitish gray below.

The coloration of the present species is striking and almost unique among bats. The white patches are possibly in part due to albinism, but this does not seem at all probable. The spots are symmetrical in form and position, and the white is confined to the surface, the under fur being blackish, like the under fur on the rest of the body, whereas in white spots due to albinism the white extends to the base of the fur.

Explorations recently made in Southern California present in striking relief the ignorance of its mammalian fauna which prevailed to within a recent date, and warrant the supposition that further novelties still await discovery. Just three years ago Dr. Merriam described from San Bernardino County a new fox (*Vulpes macrotis*) † with remarkably large ears, and very unlike anything previously known from North America. The species was based on a single specimen, but subsequently others were

* Monatsb. Akad. Wissen. Berlin, 1875, p. 788, pl., fig. 2.
† Proc. Biol. Soc. Washington, Vol. IV, 1886–88, pp. 5–7. Extras issued Feb. 18, 1888.

obtained, and its known range extended eastward into Arizona. The wonder now is that so conspicuous an animal should have so long escaped observation.

It is of course not remarkable that among the comparatively inconspicuous burrowing mammals many new forms should come to light, including some with very strongly pronounced characters; or that some form of *Nyctinomus*, known for many years as Californian on the basis of a single record, should prove common, as has now been recently found. This, although a tropical genus, is well represented near our southern border and thence southward. The case, however, is quite different with the *Promops* section of the genus *Molossus*, where *M. perotis* finds a geographical representative in Merriam's *M. californicus* of Southern California. This immense bat, one of the largest known from America, is now represented by numerous specimens (I have myself examined nine), and proves to have no very close relation to *M. perotis;* though of equal size, it differs widely in coloration, and more or less in various points of structure, as shown by direct comparison with Wied's type of *M. perotis*, preserved in this Museum.

The present species adds another to the many surprises this general region has recently supplied to the mammalogist, finding as it does its nearest allies at far remote points on the opposite side of the equator.

ARTICLE XIII.—*Further Notes on Maximilian Types of South American Birds.* By J. A. ALLEN.

Since the publication of my paper "On the Maximilian types of South American Birds in the American Museum of Natural History," in December, 1889,* the types of Maximilian's *Anthus pœcilopterus* have come to light, and it has been found that the type of Maximilian's *Myiothera ardesiaca* was wrongly referred to *Hypocnemis myiotherina* (Spix), from which it proves to be even generically distinct, and also not referable to any of the commonly recognized genera.

## **Rhopocichla,** gen. nov.

Bill much compressed and attenuated; width and depth at nostrils equal; wings rounded, shorter than the graduated tail; tarsi long and slender, smooth, the scutes obsolete.

Type, *Myiothera ardesiaca* Wied.

This genus is allied to *Pyriglena*, but has the bill much more compressed, the tail relatively longer, as also the tarsi, which are not obviously scaled. The plumage is not black, and there is no concealed white at the base of the interscapulars.

## **Rhopocichla ardesiaca** (*Wied*).

"*Myiothera ardesiaca* LICHT., MS. Mus. Berl."

*Myiothera ardesiaca* WIED, Beitr. Naturg. Bras., III, 2, 1831, p. 1055.

*Myrmeciza ardesiaca* WIED (MS., on label and in his MS. Catalogue).

*Formicivora ardesiaca* MÉNÉTR., Mém. Acad. St. Pétersb., sér. vi (Sci. Nat.), I, 1835, p. 507 (ex Wied).

*Myrmonax ardesiaca* BURM., Thiere Bras., III, 1856, p. 65 (in part).

*Myrmonax myiotherinus* CAB., Orn. Not. in Wiegm. Arch., 1847, i, p. 210 (in part).

*Formicarius* (*Myrmoborus*) *myiotherinus* GRAY, Hand-l. Bds., I, 1869, p. 300, No. 4443 (in part).

*Formicarius myiotherinus* GIEBEL, Thes. Orn., I, 1875, p. 179 (in part).

*Hypocnemis myiotherina* TACZ., Orn. Pér., II, 1884, p. 65 (in part).—RIDGW. (MS. label).—ALLEN, Bull. Am. Mus. Nat. Hist., II, No. 3, Dec. 1889, pp. 255, 275.

*Adult Male* (No. 6827, Am. Mus. Nat. Hist.).—Above nearly uniform dark plumbeous, wings and tail (especially the latter) darker; below deep ash gray, a little lighter on the middle of the abdomen; whole throat including fore neck deep black, strictly limited laterally to the space between the mandibular rami;

* Bull. Am. Mus. Nat. Hist., Vol. II, No. 3, pp. 209–276.

cheeks, sides of face, including eye-region and ear-coverts, ash gray, like the lower parts; lesser, median, and greater wing-coverts black, broadly edged with pure white; outer web of first primary edged with white; rest of remiges edged with gray, and the rectrices with deep plumbeous, like the color of the back; axillaries and inner surface of wings gray, like the flanks. Bill dusky horn-color; feet lighter. "Iris carmine red" (*Wied*).

Length, 6.45 in.; wing, 2.95; tail, 3.12; culmen, .70; tarsus, 1.17; hind toe with claw, .67; middle toe with claw, .78.

*Adult Female.*—"Above pale grayish brown, shoulders, and upper back grayer; lower back and larger wing-coverts more washed with yellowish brown, the latter edged with a lighter tint of the same; lower parts pale reddish yellow, darkest on the breast; under wing-coverts reddish yellow" (*Wied*, l. c.).

Only the male, of the two birds described by Wied, is now in the collection of the American Museum.

This species has a curious history, and apparently has not been seen by any of the writers who have referred to it, it being thus far known only from Wied's description. While generally synonymized with what is now known as *Hypocnemis myiotherina* (Spix), it has no close relationship with it, the resemblance in color being by no means exact. While both are gray birds, with a black throat, the black in the present species is confined within the mandibular rami, while in the other it extends over the cheeks and the whole sides of the face to and including the region surrounding the eyes. While *H. myiotherina* has of course a short tail, the present species is one of the longest tailed forms of the subfamily. As early as 1847 Cabanis (l. c.) started the error of synonymizing the two species; Burmeister (l. c.), in 1856, strangely confounded the two birds in his description as well as in his text, the result being a hypothetical composite species.

Mr. Sclater, in 1858 (P. Z. S., 1858, p. 288), placed Wied's *Myiothera ardesiaca* in his "list of species not recognized," but on p. 251 (l. c.), under *Hypocnemis myiotherina*, he says: "I do not believe *Myiothera ardesiaca* of Prince Max. of Neuwied to be the same as this species; but I have never seen specimens of it. It is referred here by Cabanis and Burmeister." In his late Catalogue of the *Formicariidæ* (Cat. Bds. Brit. Mus., Vol. XV, 1890) it is apparently not mentioned.

In the absence of proper material for comparison Mr. Ridgway and myself naturally followed previous authors in referring it to *Hypocnemis myiotherina*.

## Geobates pœcilopterus (*Wied*).

*Anthus pœcilopterus* WIED, Beitr. Naturg. Bras., III, i, 1830, p. 633.
*Anthus*, sp. incog. ALLEN, Bull. Am. Mus. Nat. Hist., II, No. 3, 1889, p. 215.
*Geobates pœcilopterus* SCL., P. Z. S., 1866, p. 205, pl. xxi; Cat. Bds. Brit. Mus., XV, 1890, p. 4.—ALLEN, Bull. Am. Mus. Nat. Hist., II, No. 4, 1890, p. viii.

Since my former note on this species, to the purport that the types were not in this Museum, the two original Maximilian specimens have come to light, and are fortunately in an excellent state of preservation, with, furthermore, the original Maximilian labels still attached to them. As before said, they are not entered in the Wied MS. Catalogue, and had been misplaced in the collection before it came under my charge.

The two birds agree respectively with Wied's "Beschreibung des männlichen Vogels," and with that designated as "Weibchen, welches noch jung schien," the latter being distinguished by having the feathers of the upper parts edged with pale reddish ("hell röthliche"). The birds are labeled with a small paper tag as follows: "No. 393, Fem. 393 Mas. J.," although in the "Beiträge" the sexes are reversed. A larger label (on ordinary writing paper, about 1¾ by 2⅓ inches in size, and apparently the original field label), covering both specimens, is inscribed, on one side "Ist mein *Anthus pœcilopterus*," the first two words being in German script. On the reverse, also in German script, is the following: "Ein junger Vogel aus dem ich nichts zu machen weiss. Selbst der genus ist schwer zu bestimmen. Am besten möchte er zu *Myiothera* stimmen. Aber im ausgefiederten zustand könnte es auch ein *Anthus* sein."

Wied's specimens agree perfectly with Mr. Sclater's figure and description (l. c.), leaving no question of the correctness of the identification of Wied's species by von Pelzeln.

## Chætura cinereiventris *Scl.*

*? Cypselus acutus* WIED, Beitr. Naturg. Bras., III, i, 1830, p. 351.
*Chætura cinereiventris* ALLEN, Bull. Am. Mus. Nat. Hist., II, No. 3, Dec., 1889, p. 261.

Since my former reference to this species (l. c.) Wied's specimen has been found and proves to be an example of *Chætura cinereiventris* Scl., with which species Wied's *Cypselus acutus* has

been generally heretofore synonymized. The specimen (No. 5864 *bis*, "Mas.") is still in good preservation, and agrees well with his description. He seems to have had only the single male specimen, taken in the vicinity of Bahia.

ARTICLE XIV.—*Notes on a Collection of Mammals from Costa Rica.* By J. A. ALLEN.

I am indebted to Mr. George K. Cherrie, Taxidermist and Acting Curator of Mammals, Birds, and Reptiles, in the Museo Nacional de Costa Rica, for the opportunity of examining the mammals which form the basis of the present paper. They belong in part to the Museo Nacional, and in part personally to Mr. Cherrie. The American Museum is indebted to the authorities of the Museo Nacional and to Mr. Cherrie for a set of duplicates from the joint collection here under notice.

The collection numbers altogether about 100 specimens, partly skins and skeletons, and partly spirits specimens, representing 38 species. The Carnivores and the larger mammals generally are scantily represented; the Bats also are not numerous, but the collection is rich in *Muridæ*, of which there are nine species, three of them apparently new to science. There is also a new *Blarina*, which, very surprisingly, turns out to belong to the 32-toothed section of the genus, not before reported from south of the United States. Many of the specimens were collected by Don Anastasio Alfaro, Director of the Museo Nacional de Costa Rica, but the greater part by Mr. Cherrie. Most of the alcoholics were obtained on La Carpintera, a mountain situated eight miles east of San José, at an altitude of about 6000 feet, during the months of October, November, and December, 1890.

The officials of the Costa Rica Government, we are gratified to learn, take great interest in collecting and making known the natural history productions of the Republic, and provide liberally for the development of their rapidly growing Museum. Mr. Cherrie informs me that further collections of Costa Rican mammals will probably be forwarded to this Museum for identification.

In addition to the collections already mentioned I have examined in the present connection the entire series of Costa Rican and Mexican *Muridæ* belonging to the United States National Museum, including the types of Dr. Coues's *Hesperomys melanophrys*, kindly loaned me for this purpose by the authorities of the National Museum.

**1. Mycetes palliatus** *Gray.* — A dozen specimens of this common Howler are included in Mr. Cherrie's collection.

**2. Ateles geoffroyi** *Kuhl.*—The several specimens of *Ateles* collected by Mr. Cherrie seem referable to this species.

**3. Cebus hypoleucus** (*Humb.*).—Three specimens.

**4. Felis pardalis** *Linn.*—Represented by several skins and skulls.

**5. Procyon lotor hernandezii** (*Wagler*). — Two skeletons and one skin, La Carpintera. The skulls are slightly larger than those of *P. lotor* of corresponding age from the United States, but present no other noteworthy differences.

**6. Cercoleptes caudivolvus** (*Pall.*).—Skins, skeletons and skulls, including skulls of young still retaining the milk dentition. La Carpintera, Sept.-Nov., 1890, George K. Cherrie.

**7. Conepatus mapurito** (*Gm.*).—Represented by a single half-grown specimen.

**8. Galictis barbara** *Linn.*—The collection contains a single specimen of this common Costa Rican mammal.

**9. Atalapha frantzii** *Peters.*—One specimen, ♂ ad., in spirits, La Carpintera, Nov., 1889, George K. Cherrie.

This specimen is rather larger than the average of *A. noveboracensis* (fore arm 1.60 in., tibia .80), the apical half of the interfemoral membrane is nearly naked (quite so towards the margin), the wing membrane behind the fore arm is entirely bare, and the tipping of the fur of the dorsal surface is bright red.

**10. Vesperus fuscus** *Beauv.*—One specimen, ♀ ad., in spirits, San José, May, 1888, A. Alfaro.

**11. Glossophaga soricina** (*Pall.*). — Adult ♀ in spirits, La Carpintera, altitude 6000 feet, Nov., 1890; three skins, ♂, San José, July 31 and Nov. 12, 1889, A. Lizano.

**12. Carollia brevicauda** (*Wied*).—One specimen, ♀ ad., in spirits, La Carpintera, altitude 6000 feet, Nov., 1890, George K. Cherrie.

The color of this specimen is ashy brown, with no trace of rufous, thus very different in coloration from *C. castanea*, recently described from Costa Rica by Dr. H. Allen.*

**13. Artibeus carpolegus** *Gosse* (*?*).—Three skins with skulls (two females and a male, all adult), San José, June 9, 1889, C. F. Underwood. The male is everywhere uniform sooty brown; the females are faintly rufescent on the breast, nuchal region and anterior part of the back. They agree in size and coloration with the pair received from Dr. Buller collected at Tehuantepec. (See antea, pp. 170–173, and 181.)

## 14. Blarina costaricensis, sp. nov.

One specimen, in spirits, from La Carpintera, collected Oct., 1890, by George K. Cherrie.

Much larger than the largest specimen of a large series of *Blarina talpoides* from various New York State localities, but not distinguishable in coloration from average adult examples of this species. Above entirely sooty blackish-brown, a little paler and grayer below, with a faint brownish suffusion over the pectoral region.

Length of head, 28 mm. (1.10 in.); head and body, 89 (3.50); tail, 28 (1.10); fore foot, 10.7 (.42); hind foot, 15.2 (.60). Skull, total length, 24.4 (.96); basal length, the same; greatest width, 13.5 (.53); lower jaw (point of incisors to condyle), 15.7 (.62); upper tooth-row, 10.9 (.43); lower tooth-row, 12.2 (.38).

This species is in all respects a typical *Blarina*, the number of upper unicuspids being 5, and the total number of teeth 32 ($=\frac{20}{12}$). Their relative size is the same as in *B. talpoides*, but the dentition is heavier, and the skull much larger. The specimen is a fully adult animal, with the teeth well worn. It also presents an imperfection in the teeth of the right side above, through the absence of the fourth unicuspid, which has fallen out, leaving a well-marked diastema on that side between the third and fifth unicuspids, about equal to the size of the fourth unicuspid of the opposite side.

Although this species is about twice the size of *Blarina* (*Soriciscus*) *micrura*, it was presumed to be referable to the subgenus *Soriciscus* till on removal of the skull it proved to belong to the 32-toothed section of the genus, and thus a true *Blarina*, with

* Proc. Am. Phil. Soc., XXVII, 1890, p. —.

which its size also accords. The discovery of a true *Blarina* in Costa Rica extends the distribution of the subgenus *Blarina* hundreds of miles to the southward of its previous known range, it not having been previously reported from south of the southern portion of the United States. So surprising was this discovery that I wrote to Mr. Cherrie asking him if by any possibility there could be a mistake as to the locality. He replied emphatically in the negative, the specimen having been taken by himself in Costa Rica at the locality above stated.

**15. Sciurus hypopyrrhus** *Wagler.*—In the series of eight specimens representing this species the lower parts are either uniform deep rufous, or deep rufous blotched irregularly with pure white, varying from a few small spots of white on the middle of the breast and axillæ to large areas of white, distributed over the lower abdomen as well as on the pectoral region, in some cases covering nearly half of the lower surface. The upper surface varies in different specimens from black or dark brown, with the hairs broadly ringed subterminally with pale rufous, to specimens with broad lateral bands of creamy white, and the middle of the dorsal area dark brown, varied with buff. There are various intermediate stages. The two specimens differing most widely are females, taken in the month of July. Mr. Cherrie informs me that in a series of sixty specimens examined by him no two were alike in coloration. The present series shows that the variation is not wholly seasonal, and is not due to differences of age or sex. They are all referable to the "*rigidus* type" of Alston.

### 16. Sciurus æstuans hoffmanni *Peters.*

*Sciurus æstuans* var. *hoffmanni* PETERS, Monatsb. K.-P. Ak. Wiss., Berlin, 1863 (1864), p. 654.—THOMAS, P. Z. S., 1880, p. 401 (in text).

*Sciurus æstuans* var. *rufoniger* ALLEN, N. Am. Roden., 1877, p. 757.

*Macroxus griseogena* GRAY, Ann. & Mag. Nat. Hist., 3d Ser., XX, 1867, p. 429.

*Sciurus griseogenys* ALSTON, P. Z. S., 1878, p. 667.

*Sciurus æstuans* THOMAS, P. Z. S., 1880, p. 400.—ALSTON, Biol. Cent.-Am., Mam., June, 1880, p. 132.

*Sciurus hoffmanni* ALLEN, Bull. U. S. Geol. Surv., IV, 1878, p. 885.

Four specimens, taken as follows: ♂, Santa Clara, Dec. 18, 1885, A. Alfaro; ♂, March 29, ♀, March 27, 1890, Talamanca,

G. K. Cherrie; ♂ ad., Bebedero, Jan., 1890, C. F. Underwood. The December specimen is in fuller softer pelage than the others, and is much lighter and more yellowish above. The March specimen is much darker and the pelage is shorter, probably representing the summer coat.

### 17. Sigmodon hispidus toltecus (*De Saussure*).

*Sigmodon hispidus berlandieri* ALLEN, Bull. Am. Mus. Nat. Hist., III, No. 1, Dec., 1890, p. 186 (in part, the Tehuantepec specimen only).

Two specimens, Talamanca, March 21, 1890. One is labeled "♀, 7 fœtuses. L. 6.75, t. 5.00."

These agree with Tehuantepec specimens in the U. S. National Museum, collected by Prof. Sumichrast, and differ from specimens from the Lower Rio Grande (Brownsville, Texas) and Northern Mexico in their much deeper, more rufous coloration, in this respect much more closely resembling North Carolina and Florida specimens than those from the Rio Grande region.

The series of over 100 specimens of *Sigmodon* before me fall (exclusive of the peculiar *S. fulviventer*, based on a single specimen from Zacatecas, Mex.) into four easily distinguishable groups: (1) *S. hispidus*, from the Carolinas, Georgia, and Florida; (2) *S. h. littoralis*, of the sea-coast of southeastern Florida; (3) *S. h. belandieri*, of the Rio Grande region and southward over much of Mexico (at least to Colima and San Luis Potosi); (4) *S. h. arizonæ*, the very large pale form of the desert regions of the southwestern United States; (5) *S. h. toltecus*, of the *tierra caliente* of Southern Mexico and southward to Costa Rica. The two forms most resembling each other in coloration are, strange to say, the Central American *toltecus* and true *hispidus* from the Carolinas, characterized by their rich brown tints, in comparison with the gray-black *littoralis* and the bleached *berlandieri* and *arizonæ* types. The *toltecus* form, however, averages the deeper and richer in its tints, some specimens being rich rusty brown, in strong contrast with the pale bleached gray form (*berlandieri*) of the dryer regions to the northward.

As De Saussure's type of *toltecus* was from Vera Cruz, and proves on comparison to agree with Tehuantepec specimens rather than with the Rio Grande form, the dark southern race

may be recognized under this name. It seems to average smaller than either *hispidus* or *berlandieri*, with larger ears and a much longer tail, while the coloration is more rufous than in true *hispidus*, though some of the specimens of the *toltecus* and *hispidus* series are, as already said, very similar in coloration.

The following table, based on measurements made from the fresh specimens by the collectors, gives (in millimeters) the average length of the head and body, and the length of the tail in the several forms here recognized.

| | No. of specimens. | Head and body. | Tail. |
|---|---|---|---|
| *Sigmodon hispidus* | 10 | 161.9 | 100.9 |
| " " *littoralis* | 8 | 171.1 | 104.6 |
| " " *berlandieri* | 8 | 152.5 | 91.5 |
| " " *toltecus* | 4 | 145.2 | 119.3 |
| " " *arizonæ* | 3 | 182.3 | 130.3 |

## 18. Hesperomys (Habothrix) teguina *Alston.*

*Hesperomys teguina* ALSTON, P. Z. S., 1876, p. 755; Biol. Centr.-Am., Mam., Aug., 1880, pp. 142, 144, pl. xiv, fig. 1.

Two specimens, ♀ ad., and ♀ young, in spirits, from La Carpintera, Oct.–Dec., 1890, George K. Cherrie.

These specimens appear to agree satisfactorily with Alston's description of his *H. teguina* (l. c.), described from a single mounted specimen in the British Museum, from Coban, Guatemala. As he says, it is a "very peculiar small dark short-tailed mouse," which he refers provisionally to the subgenus "*Vesperomys*" (= *Vesperimus* Coues). "In the comparative shortness of its tail and its nearly uniform rich coloration it is strikingly different from all the Nearctic Mice, and also from all the Neotropical forms with which I am acquainted." He gives the "approximate measurements of the mounted type specimen" as follows:

| | Inches. |
|---|---|
| Length of head and body | 3.25 |
| " tail (tip imperfect) | 1.90 |
| " ear | 0.40 |
| " hind foot | 0.65 |

In coloration the present specimens agree essentially with Alston's description; the measurements do not conform so well; but Alston's measurements could be only approximate, from the

nature of the specimen, the tail being imperfect, and the body possibly over-stuffed. The specimens here described are both females; while one, as shown by the skull, is fully adult, the other is evidently not fully grown. With these allowances it seems safer to refer the present specimens to *H. teguina* than to treat them as representing an undescribed species. It seems, however, desirable to indicate their characters.

*Female, ad.*—Pelage short, thick and close. Above dark brown, the tips of the hairs dull rufescent; sides paler and more ashy, passing gradually into the dark ashy fawn color of the lower surface, the fawn color strongest over the pectoral region. Edges of the lips lighter (whitish in alcohol). Ears moderate, blackish, nearly naked externally, sparsely clothed with short rufescent hairs on the inner surface. Tail uniform blackish, thickly covered with short brownish-black hairs, forming a slight pencil at the tip. Both fore and hind feet brownish black, like the tail and ears. Soles, posterior to the prominent black tubercles, thickly covered with very short dusky brown hairs. Incisors pale yellowish white. Mammæ, $\frac{0-2}{0-2}=4$.

*Female, immature.*—Similar to the adult, but rather less strongly tinged with fawn below.

*Measurements.*— ♀ ad. Head and body, 71 mm. (2.80 in.); tail vertebræ, 57 (2.25); hind foot, 17.8 (.70); ear, 10.7 (.42).

♀ immature. Head and body, 66 (2.60); tail vertebræ, 54 (2.12); hind foot, 17 (.67); ear, 10.2 (.40).

*Cranial Characters.*—The skull, compared with that of a specimen of *H. leucopus* of corresponding age, from Suffolk County, Long Island, N. Y., is much shorter and broader, the rostral portion being especially shortened and broadened. Although the skull is fully a third smaller, the tooth row is longer and broader, the dentition being heavier (absolutely as well as relatively). The molars, instead of becoming narrower posteriorly, are of nearly equal size throughout the series, and present a very different crown-pattern. The lower jaw is entirely different in outline, the condylar portion being much less inclined backward; the coronoid process is much heavier and more vertical, and its apex just reaches the plane of the condyle; the angle is broader, more produced, and much more strongly inflected at the lower border.

The crowns of the teeth are well worn. The lateral infoldings of enamel are very slight; on the external border of the first and second upper molars the hollow between the cusps is exceedingly slight, and only a little more pronounced on the inner border; it is more strongly marked in the lower molars.

Basilar length of the skull, 18.5 mm. (.73 in.); total length, 22.8 (.90); greatest breadth, 12.7 (.50); length of nasals, 8.1 (.32); of upper molar series, 4.6 (.18); of lower molar series, 5.1 (.20).

## 19. Hesperomys (Habrothrix) caliginosus *Tomes?*

*? Hesperomys caliginosus* TOMES, P. Z. S., 1860, p. 265 (Ecuador).

*? Hesperomys (Habrothrix) caliginosus* THOMAS, P. Z. S., 1882, p. 110 (Huambo, Peru); *ibid.*, 1884, p. 456 (Central Peru).

Two specimens, skins (♀ and ♀ juv.), San Carlos, Dec., 1888, A. Alfaro. Also, 5 specimens, skins, Pacuare, May, 1876, J. C. Zélédon (Coll. U. S. Nat. Mus.).

These specimens agree well in size, proportions and coloration with Tomes's description of his *Hesperomys caliginosus*, from Ecuador, and apparently with the Peruvian specimens referred to this species by Mr. Thomas. The latter, however, has thrown doubt (P. Z. S., 1884, p. 457) as to what Tomes's *H. caliginosus* may really be, there being in the British Museum collection "a species, represented by three specimens, agreeing *externally* quite as well as these with Mr. Tomes's description, but whose skull is wholly different, and proves it to belong to the subgenus *Oryzomys*. To which of these two species therefore the name *caliginosus* is really referable is a question which can only be settled by an examination of Mr. Tomes's type." As, however, Mr. Tomes describes the head and face as short, "much as in the *Arvicolidæ*," the tail short, etc., it would seem more probable that his species was an *Habrothrix* rather than an *Oryzomys*.

## 20. Hesperomys (Tylomys) nudicaudus *Peters.*

*Hesperomys (Tylomys) nudicaudus* PETERS, Monatsb. Ak. Berlin, 1866, p. 404, figs. 1–4, skull.

*Hesperomys nudicaudus* ALSTON, Biol. Centr.-Am., Mam., 1880, p. 149.

A single skin, without skull, is provisionally referred to this species, described by Dr. Peters as above from a single specimen from Guatemala, apparently the only example known to be extant in museums as late as 1880. In size, proportions, and coloration, and in the nakedness of the soles, tail and ears, it agrees well with Dr. Peters's description.

Except for the very long naked tail, the present specimen has the general external appearance of a *Neotoma*. The specimen may be described as follows:

Pelage very long, soft and full. Above strong yellowish brown, much varied with black, the fur being plumbeous for three-fourths of its length, then broadly

ringed with rather dark yellowish brown, with most of the hairs conspicuously tipped with blackish. This gradually passes into the light color of the ventral surface, which is clear white on the throat, upper breast, and sides of the chest, and buffy white over the rest of the ventral surface (as well as can be judged, owing to the bad state of the skin). Fore arms, sides of the muzzle, cheeks, and front of the head to beyond the eyes, dusky ashy, somewhat darker around the eyes, forming a well-marked dusky brown eye-ring. Inside of fore and hind limbs soiled whitish ; upper surface of both fore and hind feet dusky brown, the tips of the toes whitish. Whiskers abundant, very long and black. Ears very thin, blackish, and entirely naked on both surfaces. Palms and soles entirely naked ; tail naked, the very minute scattered hairs being scarcely visible. The basal half of the tail is dusky, the apical half whitish, the line of demarkation fairly distinct.

*Measurements.*—The collector's label attached to the skin reads as follows : Length (total), 18.95 ; tail, 9.50,—dark part 4.83, light part 4.67 ; hind foot, 1.50.

**21. Hesperomys (Vesperimus) leucopus sonoriensis** (*Baird*).—One specimen, ♂ adult, in spirits, from La Carpintera, Oct. or Nov., 1890.

This single specimen is obviously a member of the *sonoriensis* group. It is, however, considerably below the average size of specimens of even the Arizona phase of *sonoriensis*, but presents no other tangible features of difference. Its measurements are as follows : Total length, 142.2 mm. (5.60 in.); head and body, 81.3 (3.20) ; tail to end of vertebræ, 57.9 (2.28) ; tail to end of hairs, 61 (2.40) ; ear from crown, 12.7 (.50) ; hind foot, 19.8 (.78). The tail is distinctly bicolor, but less dark above than in ordinary *sonoriensis*. The teeth are slightly worn, but neither these nor the skull present any distinctive features. Probably a series of specimens would show that this form is separable from true *sonoriensis*.

**22. Hesperomys (Vesperimus) cherrii,** sp. nov.

Six specimens, as follows : skin ( ♂ ? adult), San José, June 9, 1889, C. F. Underwood ; five specimens in spirits (2 ♂ ad., 1 ♀ ad., and 2 half-grown young), La Carpintera (altitude about 6000 feet), Oct.–Nov., 1890, George K. Cherrie.

About the size and of much the same general coloration as *H.* (*Vesperimus*) *aureolus*, but whiter below, with larger and darker ears, and tail nearly twice as long as in the latter. Also with dusky instead of yellowish feet.

Above dark cinnamon rufous, darker and mixed with blackish on the head and middle of the dorsal region, passing into pure deep rusty cinnamon on the flanks; ventral surface pure white sharply defined against the rich deep golden rufous of the flanks; pelage of the dorsal surface basally deep slaty; of the ventral surface, pale ashy; sides and top of muzzle dusky grayish. Upper surface of both fore and hind limbs, as far as the base of the toes, dusky brownish; toes nearly naked, soiled white. Ears large, dusky, scantily clothed externally and at the base with dusky hairs. Soles naked, 6-tubercled; toes short, third and fourth equal, second barely shorter; fifth slightly shorter than second, about .07 in. shorter than the fourth; first reaching to middle of basal phalanx of the second. Tail very long, naked, uniform dusky brown, the annulations very distinct. Mammæ, $\frac{1-2}{1-2}=6$.

Length of head and body, adult ♂ (from spirits specimens), 72.4–73.7 mm. (2.85–2.90 in.); tail, 108–114.3 (4.25–4.50); hind foot, 18.3 (.72); ear from crown, 12.7 (50).

Skull and dentition strictly of the *Vesperimus* type; skull a little smaller than in *H.* (*V.*) *aureolus*, the facial region narrower, and the anteorbital portion narrower and longer. Basal length, 20.3 (.80); total length, 24.6 (.97); greatest width, 13.5 (.53); least interorbital width, 4.3 (.17); nasals, 9.4 (.37); upper molar series, 4.1 (.16); lower molar series, 4.6 (.18); length of lower jaw (tip of incisors to condyle), 13.5 (.53); height at condyle, 5.8 (.23).

The four adults appear to vary but little in size or coloration; the half-grown young are darker, and less strongly rufous on the sides.

This species bears a strong resemblance to *Hesperomys fulvescens* of De Saussure (Rev. et Mag. de Zool., 2° sér., XII, 1860, p. 98, 102), from Mexico, which by some authors has been synonymized (as I think prematurely) with *H. aureolus* of the eastern United States. It is of the same size, with the same relative length of tail, and the same dusky gray ears. In these two latter points they both differ from *H. aureolus*, which has yellowish brown ears, with the tail only about as long as the body without the head, instead of longer than head and body together. *H.* (*V.*) *cherrii* differs from *H. fulvescens*, however, in too many points to render it probable that they are identical, the tail in *H. cherrii* being very much longer than in *H. fulvescens*, and the ventral surface is pure white, sharply separated from the deep rusty cinnamon of the flanks, which terminates abruptly at its lower border, whereas in *H. fulvescens* De Saussure says: "Sur le côtés, la teinte devient graduellement plus pâle et plus fauve et finir par passer

à la couleur fauve pâle qui couvre toutes les parties inférieures. Il n'y a pas de ligne de démarcation entre la coleur du ventre et celle des flanc ; ces couleurs se fondent." And again : "Cette espèce sera facile à reconnaître à la couleur fauve de ses parties inférieures." The feet also are "d'un fauve pâle," and not dusky brown, as in *H. cherrii.*

This species is named in honor of Mr. George K. Cherrie, of the Museo Nacional of Costa Rica (formerly of the American Museum of Natural History), to whom I am indebted for the material forming the basis of the present paper.

### 23. **Hesperomys (Vesperimus?) nudipes,** sp. nov.

One specimen, ♀ ad., in spirits, La Carpintera, Oct., 1890, George K. Cherrie.

Size of a half-grown black rat (*Mus rattus*); skull and dentition as in *Vesperimus*, but tail and feet naked ; ears very large, naked ; feet (as regards relative length of digits, etc.) as in *Vesperimus.*

Pelage full, soft. Color above dark brown, the hairs narrowly tipped with pale rufous, imparting a faint yellowish brown suffusion, which becomes stronger and more rufous on the sides ; beneath grayish white, the hairs dusky for the greater part of their length, narrowly tipped with white ; a broad band of pale chestnut across the breast. A large dusky spot at the base of the abundant very long whiskers, and another in front of the eye, continued beneath the eye as a narrow dusky streak. Top and sides of the nose grayer than the back, thinly haired. Fore and hind feet naked both above and below, the fore feet flesh-colored on both surfaces to above the wrists, the hind feet flesh-colored above, dusky gray on the 6-tubercled soles, with a very few short blackish hairs on the proximal third of the upper surface ; distal fifth of tibiæ also nearly naked, being only thinly clothed with short dusky fur. A few short bristly white hairs at the base of the claws on both fore and hind feet. Tail grayish brown, gradually becoming a little lighter at the extreme tip, naked, *the annulations very narrow.* With a lens the tail and the upper surface of the feet can be seen to be covered with very short whitish hairs, which do not in the least obscure the annulations. Mammæ, $\frac{0-2}{0-2}=4$.

Total length, 230.9 mm. (9.90 in.) ; head, 40.6 (1.60) ; head and body, 137.2 (5.40) ; tail, 139.7 (5.50) ; hind foot, 28.5 (1.12) ; fore foot, 14.5(.57) ; ear from crown, 20.3 (.80) ; longest whiskers, 50.8 (2.00).

*Skull.*—Total length, 36.9 (1.44) ; basal length, 31.2 (1.23) ; greatest breadth, 16.5 (.65) ; length of nasals, 14.5 (.57) ; length of lower jaw (from point of

incisors to condyle), 22.4 (.88); height at condyle, 7.9 (.31); length of the upper molar series, 5.1 (.20); lower molar series, 56 (.22).

The rostral portion of the skull is unusually narrow and attenuated, even for a *Vesperimus*, the relative length of the nasals to the entire length of the skull being as 39 to 100. The structure of the skull and teeth is entirely that of a typical *Vesperimus*, with the slightly ridged supraorbital border common to the larger forms of the group. The relative size of the feet, the relative length of the digits, the large ears, and the length of the tail are all as in *Vesperimus*, from typical members of which group it differs in its very large size and in the extreme nakedness of the feet and tail.

### 24. **Hesperomys (Oryzomys) alfaroi,** sp. nov.

Five specimens, skins (one ♂ ad., 4 ♀ ♀ ad.), San Carlos, Dec., 1888, A. Alfaro.

*Female Adult.*—Pelage moderately full, short, soft. Above pale rusty yellowish brown, varied with black; sides of head and body much more rufous, varying in different specimens from light yellowish rusty to brownish rusty; below ashy white, the line of demarkation between the colors of the ventral and dorsal surfaces well defined. Upper surface of both fore and hind feet nearly naked, especially of the hind feet, being very scantily clothed with very short yellowish ashy hairs. Ears rather large, dusky, nearly naked on the inner surface, scantily covered with short dusky hairs on the external surface. Soles naked, dark brown, distinctly 6-tuberculate. The three middle digits of the pes are subequal and long; the first is very short, the fifth intermediate between the first and fourth. Tail long (about equaling head and body), naked, faintly bicolor, upper surface blackish brown, the lower surface ashy brown. Mammæ, $\frac{1-2}{1-2}=6$.

Length (approximate from skins) of head and body, 95.3 mm. (3.75 in.); tail, 88.9 (3.50); hind foot, 23.4 (.92); ear from crown, 10.2 (.40).

The five skins, although apparently all adult, differ much in color; the palest (sexed ♂ by the collector) is nearly of the color above of a very old house mouse (*Mus musculus*), though darker, less gray, and more mixed with pale rufous, especially on the sides, where this color prevails, while the ventral surface is clear ashy white, in sudden and decided contrast to the upper surface. The darkest specimen borders on cinnamon rufous above, mixed with black over the middle region, passing into clear pale cinnamon on the sides.

On removing the skulls from the skins all were found to be badly mutilated, two of them consisting of little more than the nasal portion and incisors; the best one lacks only the posterior half of the brain-case. There is a faint indication of a supra-orbital ridge; the facial portion of the skull is very short; the suborbital foramen is as in *Oryzomys palustris*; the molars are very broad and low-crowned. The first upper molar is distinctly 6-tubercled. The condylar portion of the lower jaw rises far above the plane of the molars; the coronoid process is rather short and broad.

This species needs no comparison with any thus far described from any point north of the Isthmus of Panama; it may have near relatives in northern South America, but I am unable to identify it with any of the described species.

While the ears are very large and the tail relatively short, it seems on the whole better referable to the subgenus *Oryzomys* than to any other yet characterized.

This species is named in honor of Don Anastasio Alfaro, the well-known Director of the National Museum of Costa Rica, by whom the specimens on which the species is based were collected.

**25. Heteromys longicaudatus** *Gray.*—Three specimens in spirits, La Carpintera, Oct., 1890, George K. Cherrie.

These specimens appear to be referable to what Alston has recognized as *H. longicaudatus.* They are brownish black above, the pelage yellowish white for the basal two-thirds; whole lower surface, inside of all the limbs, cheeks, sides of nose, fore feet as far as the carpus and hind feet as far as lower part of the tibia, white; soles naked, dusky; tail sharply bicolored, the lower surface white, the upper dusky brown, scantily haired (almost naked), the annulations conspicuously visible, slightly penicillate, however, at the tip. The three specimens, while very uniform in coloration, vary greatly in measurements. One is an adult male, one an adult female (mammæ 6, all inguinal), the other an apparently full-grown female, but the mammæ as yet undeveloped. The last example has lost the apical portion (one-third to one-half) of the tail. These specimens measure as follows, in millimeters:

| Sex. | Head. | Head and body. | Tail vert. | Hind foot. | Ear. |
|---|---|---|---|---|---|
| ♂ ad. | 39.4 | 125 | 125 | 33.1 | 9.7 |
| ♀ ad. | 38.1 | 125 | 160 | 34.8 | 10.9 |
| ♀ juv. | 36.3 | 103 | ... | 34.0 | 10.9 |

The male, while much the largest bodied, has smaller ears and shorter hind feet than either of the two females, while the adult female has a much longer tail than either of the other two specimens. This variation is probably purely individual.

I have also before me five other Costa Rica skins of *Heteromys*, belonging to the U. S. National Museum, collected at Angostura and Pacuare by J. C. Zélédon in 1876. They are in very bad condition, and thus very unsatisfactory for study, two of them being bad alcoholics and the other three unfilled flat-skins with the tails imperfect. Three of them appear to agree fairly well with Mr. Cherrie's specimens; the other two show a strong suffusion of pale chestnut above, which on the sides of the body is very strong. Further reference will be made to them in a later paper in the present volume of this Bulletin.

**26. Synetheres mexicanus** (*Kerr*).—Several skeletons and skulls, La Carpintera, May, 1890, George K. Cherrie.

**27. Cœlogenys paca** (*Linn.*). — One skeleton, George K. Cherrie.

**28. Lepus gabbi** (*Allen*).—Two specimens, ♂ ad. and ♀ juv., San José, Sept., 1890, George K. Cherrie.

These two specimens have been presented to the American Museum, and are a most welcome addition. This is still apparently a rare species in collections. The two types, in the U. S. National Museum, have unfortunately become nearly destroyed by museum pests.

**29. Bradypus griseus** (*Gray*).—One specimen, ♂ (?), May, 1890. Referred provisionally to Gray's *Arctopithecus griseus.*

**30. Bradypus castaneiceps** (*Gray*).—One specimen, ♀ adult, Jimenez, Dec. 26, 1890, A. Alfaro. "With fœtus."

These two specimens may be referable to the same species, but they are very different in coloration and in cranial characters, especially in the form of the lower jaw, and seem to agree respec-

tively with what Gray has called *Arctopithecus griseus* and *A. castaneiceps*. Much more material is necessary to determine their status, and the relationship of these alleged species to *B. infuscatus* of Brazil.

**31. Cholœpus hoffmanni** *Peters.* — This species is represented by a large series of specimens, of all ages and seasons, and of both sexes. The variation in color between different individuals of the same age, sex, and season is most astonishing.

As Mr. Cherrie will soon give an account of these and other variations, based on an examination of nearly one hundred specimens, including a large series of skeletons, collected by himself, further comment is unnecessary in the present connection.

**32. Cyclothurus didactylus** (*Linn.*).—A single skin.

**33. Tatusia novemcincta** (*Linn.*).—One specimen.

**34. Didelphys marsupialis aurita** (*Wied.*). — Young, San José, May, 1888, A. Alfaro.

Mr. Oldfield Thomas, in his recent "Catalogue of the Marsupialia and Monotremata" (1888, pp. 323–329), unites all of the large opossums under the name *Didelphys marsupialis* Linn., this species, in his opinion, ranging from Southern Brazil to the northern border of the United States, he thus combining under one name some four to six species previously more or less generally recognized. To this wholesale lumping I cannot bring myself to subscribe. While the forms here combined are beyond doubt closely allied, they evidently present several geographical phases which are quite different, and respectively quite constant over large areas. While they doubtless intergrade, and while each presents a considerable range of individual variation, the purposes of science are apparently best subserved by the definite recognition of several of these forms in nomenclature, according them the rank of geographical forms or subspecies. For example, the opossum of Texas and northern Mexico is a very different animal from the opossum of the Eastern United States.

**35. Didelphys (Metachirus) quica** *Natterer.*—One specimen, skin, without definite locality.

**36. Didelphys (Micoureus) cinerea** *Temm.*—One specimen, skin and skull, young, San José, Oct. 15, 1890, George K. Cherrie.

**37. Didelphys (Micoureus) murina** *Linn.*—One specimen in alcohol, La Carpintera, altitude 6000 feet, Dec. 15, 1890, George K. Cherrie. "From the stomach of a rattlesnake."

**38. Didelphys (Philander) lanigera** *Desm.* — (*Didelphys derbiana* Waterh., and of most recent authors). One specimen, skin.

ARTICLE XV.—*On a Collection of Mammals from Southern Texas and Northeastern Mexico.* By J. A. ALLEN.

The series of mammals forming the basis of the present paper has been presented to the American Museum of Natural History by Mr. George B. Sennett, the well-known ornithologist, together with many specimens from Pennsylvania and Minnesota. The portion of the collection here especially considered was mainly gathered by Mr. Sennett and his collectors in Southern Texas and in the State of Tamaulipas, including, however, a few specimens from the States of Nuevo Leon and San Luis Potosi. The Texan specimens are principally from Presidio, Bee, Nueces, and Cameron Counties. They number about 90 specimens, representing 31 species. Two are apparently new to science, and much light is thrown upon the geographical range of many others.

**1. Lynx rufus maculatus** (*Horsf. & Vig.*).—A single specimen, skin and skull, ♀ ad., from near Brownsville, Texas, March 12, 1888, J. M. Priour. The specimen is already in the red summer coat.

**2. Canis latrans** *Say.*—One specimen, skin and skull, Aransas Co., Texas, Oct. 20, 1888, J. M. Priour.

**3. Putorius brasiliensis frenata** (*Licht.*).—A young male, Corpus Christi, Texas, May 15, 1882, George B. Sennett. This specimen has the distinctive features of coloration of *frenatus*, which does not appear to have been before recorded from the coast of Texas north of the mouth of the Rio Grande.*

## 4. Spilogale indianola?

? *Spilogale indianola* MERRIAM, N. Am. Fauna, No. 4, Oct., 1890, p. 10.

Mr. Priour collected a single specimen of *Spilogale* during his trip through Tamaulipas, but the exact locality and date seem not to have been recorded. It differs from all other examples of the genus I have seen in its very dark colors, the light markings being very much restricted and of a deep creamy white. The skull unfortunately is imperfect, consisting of only the facial portion.

* As this paper goes to press a specimen has also been received from Brownsville, through Mr. C. K. Worthen, collected Jan. 3, 1891.

It indicates a full-grown but not old individual, apparently a male, so far as can be determined from the skin. The specimen may be described as follows:

Size large; pelage coarse. Length of head and body (approximate from the skin), 330 mm.; tail vertebræ, 135; tail to end of hairs, 146; hind foot, 44. Color black or brownish black, with the usual white areas and markings very much restricted, as follows: The light spot on the forehead is pale creamy white, about the size of an ordinary pea; the lunate spot in front of each ear pale creamy white, very small, less than half an inch in extreme length, very narrow, and widely separated from the light area on the side of the neck; the two inner dorsal white stripes begin at the usual point, but are mere lines of creamy white, in places irregularly obsolete; the outer dorsal stripe begins behind the ear as a broad, clavate, deep cream-colored patch, narrowing posteriorly; the flank stripe, like all of the body markings, is deep cream color, and while of the usual pattern is very narrow, being only about one-half as wide as the black stripe above it, instead of much wider, as in *S. putorius* and allied forms. The thigh patches are little more than small tufts of creamy white hairs, and a mixture of such hairs with black at the base of the tail represents the usual rump patch. The white in the tip of the tail forms a broad terminal pencil, which extends forward on the lower surface of the tail for about an inch.

The buffy tint of the light markings may be merely individual, since a similar phase occurs in allied forms.

According to Mr. Alston* the genus *Spilogale* ranges southward to Yucatan and Guatemala, whence specimens are represented in the collections of M. Boucard and the British Museum, but I find no descriptions of these specimens. Dr. Merriam, in his recent revision of the genus,† has described a species based on two skulls from Indianola, Matagorda Bay, Texas, as *S. indianola*, the skins, and therefore the external characters, being unknown. Unfortunately the skull of the Tamaulipas specimen is too imperfect to furnish any basis for comparison with the Indianola specimens. For the present it may be best to provisionally refer this specimen to *S. indianola* Merriam, since he suggests that it is "probably a Mexican tropical species extending north along the Gulf coast of Texas."

**5. Dicotyles tajacu** (*Linn.*).—Several specimens from various localities in Texas and Tamaulipas.

* Biol. Centr.-Am., Mam., p. 83.
† North Amer. Fauna, No. 4, Oct., 1890, pp. 1-16, pl. i.

**6. Vesperugo georgianus** (*F. Cuv.*).—Two specimens, Bee Co., Texas, April, 1887, J. M. Priour.

**7. Vesperugo hesperus** (*H. Allen*).—One specimen, skin and skull, sex ?, Presidio Co., Texas, Sept., 1887, Wm. Lloyd. One specimen, skin and skull, sex ?, Monterey, Mexico, May 30, 1889, J. M. Priour.

This species, originally described from Southern California (Posa Creek and Fort Yuma), has since been recorded by Dr. Merriam* from the little Colorado River, Arizona. The present specimens show that it ranges eastward to Western Texas, and southward to Monterey, Nuevo Leon.

**8. Antrozous pallidus** (*Le Conte*).—Two specimens, skins, without labels, but probably from Presidio Co., Texas, or Nuevo Leon.

**9. Scalops argentatus texanus,** subsp. nov.

Much smaller than either *S. argentatus* or *S. aquaticus*, and bronzy chestnut brown instead of silvery plumbeous, or brownish plumbeous. Above uniform pale chestnut brown, with a decided bronzy lustre; below darker, irregularly varied with lighter areas,—rather strong chestnut with patches of rufescent ash.

Measurements (approximate from skin): head and body, 100 mm. (3.94 in.); tail, 24 (.95); hind foot, 16.5 (.65); fore foot, length, 18.8 (.74), breadth, 15.2 (.60).

Type $\frac{3488}{2740}$, sex ?, Presidio Co., Texas, Sept., 1887, Wm. Lloyd.

This is apparently a small southern form of *S. argentatus*, from which it differs markedly in its smaller size (nearly one-third smaller), and its strong bronzy chestnut coloration. The single specimen is an adult, with the teeth much worn. The skull when removed from the skin was found to be imperfect, the part posterior to the middle of the orbits having been cut away. The dentition in both jaws is intact, and the portion of the skull remaining presents nothing peculiar except small size.

Since *S. aquaticus* is represented by a similar small form in Florida (of which I have seen a number of specimens), and *Scapanus townsendii* by a corresponding form in Southern California (though neither of them have as yet been characterized), it seems reasonable to consider the present specimen as a fair representative of the Texan form of *S. argentatus*.

* N. Am. Fauna, No. 3, p. 45.

**10. Sciurus aureogaster** *F. Cuv.*—Six specimens, as follows: ♂ and ♀ ad., Tampico, Mex., June, 1888, Wm. B. Richardson; ♀ ad., Tampico, May 21, 1888, J. M. Priour; ♂ ad., and ♀ juv., Valles, San Luis Potosi, May, 1888, Wm. B. Richardson; ♀ ad., Rio Corono, Tamaulipas, April 7, 1888, J. M. Priour. (These are the specimens previously mentioned in this Bulletin—II, p. 166, and III, p. 181.)

**11. Sciurus deppei** *Peters.*—Four specimens, as follows: 2 ♂ ad., Victoria, Tamaulipas (alt. 5000 ft.), April 16 and May 1, 1888, J. M. Priour; ♂ ad., Valles, San Luis Potosi, May, 1888, Wm. B. Richardson; also one specimen without label.

These specimens vary in the color of the upper surface from olive-gray to rusty brown, and in the color of the lower surface from pale buff to ochraceous buff.

**12. Sciurus arizonensis** *Coues.*—One specimen, skin and skull, ♀ ad., San Pedro Mines, Nuevo Leon, Mex., May 7, 1889, J. M. Priour. Also one specimen, skin and skull, ♂ juv., labeled as from Brazoria Co., Texas, May 22, 1887, J. M. Priour; if this locality is not erroneous, it carries the range of the species far to the eastward of its previous known range, it not having been previously reported in the United States from east of Arizona. Mr. Priour's note-book shows that a squirrel was taken on this date at this locality (about fifteen miles above the mouth of the Brazos River, in Bee County). The skin, in all features of coloration, resembles a common phase of the Southern Gray Squirrel (*Sciurus carolinensis*), the species that would be naturally expected to occur in Bee County, but the skull lacks all trace of the small premolar almost invariably present in this species.

**13. Sciurus hypopyrrhus** *Wagler?*—In addition to the specimens of *Sciurus* above recorded are four skins without skulls, all received, Mr. Sennett informs me, from Mr. Wm. B. Richardson, but only one of them has a label, inscribed, in Mr. Sennett's hand-writing, "Tampico, Mexico, Richardson, 1888." They are all intense glossy black throughout, of large size, with very long heavy tails, and high pointed ears. They resemble a melanism of *S. hypopyrrhus*, but this species has not been reported from north of the southern border of Mexico. In three of the speci-

mens the pelage at the extreme base, on the dorsal area, is tinged with rufous, in one strongly so.

**14. Spermophilus grammurus** (*Say*).—One specimen, Presidio Co., Texas, Sept., 1887, Wm. Lloyd. This specimen represents the ordinary phase of true *grammurus*.

**15. Spermophilus mexicanus** (*Licht.*).—One specimen, ♀ ad., Pecos City, Texas, June, 1887, Wm. Lloyd. One specimen, Corpus Christi, Texas, G. B. Sennett; two specimens, ♂ ad. and juv., Xecotencatl, Tamaulipas, May, 1888, J. M. Priour.

**16. Spermophilus tridecemlineatus** (*Mitchell*).—Two specimens, Bee Co., Texas, April 30, 1887, J. M. Priour. In coloration they are not distinguishable from Minnesota examples.

**17. Mus musculus** *Linn.*—Two specimens, adult and young, Victoria, Tamaulipas, April, 1888, J. M. Priour.

**18. Ochetodon mexicanus** (*De Saussure*).—Two specimens, ♂ and ♀ adult, skins and skulls, Bee County, Texas, January, 1887, J. M. Priour. Also two specimens, ♂ and ♀ young, skins only, Santa Teresa, Tamaulipas (about fifty miles southwest of Matamoras), March 23, 1888, J. M. Priour.

The two young specimens from Santa Teresa are less than half grown, but in general coloration above exactly resemble the adults from Bee County, Texas. Below they are like a young house mouse. The Bee County specimens, in midwinter pelage, are superficially nearly pure white below, with the fur plumbeous for the basal half. Above they are mouse gray strongly suffused with yellowish brown, passing into pale orange brown on the sides. A conspicuous feature in all of the specimens is the color of the inner surface of the ears, which is strong yellowish brown, or brownish orange.

This species has been recorded from Duval Co., Texas, by Mr. Thomas,* and also from as far north as Grand Coteau, La., by Dr. Coues.†

**19. Neotoma floridana mexicana** (*Baird*).—One specimen, ♀ ad., Presidio Co., Texas, Oct. 15, 1887, William Lloyd. "Head and body, 11.75 in.; tail, 5.00."

* P. Z. S., 1888, p. 447. † Mon. N. Am. Roden., 1877, pp. 128 and 130.

**20. Neotoma micropus** *Baird.**—Three specimens, San Fernando de Presas, Tamaulipas, March 30, 1888, J. M. Priour.

**21. Sigmodon hispidus berlandieri** *Baird.*—Three specimens: ♂ ad., Corpus Christi, Texas, May 23, 1887, J. M. Priour; ♀ juv., Corpus Christi, Texas, Jan. 12, 1887; ♀ ad., San Fernando de Presas, Tamaulipas, March 26, 1888.

**22. Oryzomys palustris** (*Harlan*).—One specimen, ♂ ad., Wharton Co., Texas, May 27, 1887, J. M. Priour.

This specimen is provisionally referred to *O. palustris*, though paler and grayer than any example in a large series from Florida and Louisiana. It is much nearer this, however, than to *O. couesi* from further south.

**23. Vesperimus leucopus texanus** (*Woodhouse*).†—One specimen, Bee Co., Texas, ♀ ad., April 21, 1887, J. M. Priour.

**24. Vesperimus leucopus sonoriensis** (*Le Conte*).—Four specimens, Presidio Co., Texas, ♂ and ♀ ad., and two immature specimens in the blue pelage, Oct., 1887, Wm. Lloyd.

A single specimen from Tampico, Mexico, April, 1888, W. B. Richardson, is also provisionally referred here. It lacks the skull, and nothing is left of the tail but the unfilled curled-up skin.

## 25. Geomys personatus *True.*

*Geomys personatus* TRUE, Proc. U. S. Nat. Mus., 1888, p. 159.

In 1888 Mr. F. W. True described a new species of *Geomys*, based on two specimens from Padre Island, Texas. Mr. Sennett's collection contains four specimens, from the same locality, collected in February, 1887, by Mr. Priour. They include two very old breeding females and a half-grown young one, and a very young one taken apparently when not more than a week or ten days old. The two adults agree fairly well with Mr. True's description, but are apparently rather paler and more of an ashy ecru tint above than his description seems to imply. The half-grown example appears to agree exactly with his description. In all the specimens the lower parts are white, as described by Mr.

* The status of this form will be discussed at length in a later paper in the present volume of this Bulletin.

† See Mearns, Bull. Am. Mus. Nat. Hist., II, No. 4, Feb., 1890, p. 285.

True, this feature forming their most striking external difference from *G. busarius*, although the blackish frontal region is also in a measure distinctive.

There are also two specimens, about two-thirds grown, from Corpus Christi, that seem referable to this species.

The skull of *Geomys personatus* differs from the skull of *G. busarius* and *G. tuza* in being much heavier, with heavier dentition; while of the same length it is broader, the rostral portion being especially thickened.

**26. Perognathus flavus** *Baird.*—One specimen, skin, without skull, Presidio Co., Texas. Provisionally referred to this species.

### 27. Perognathus paradoxus spilotus *Merriam.*

*Perognathus paradoxus spilotus* MERRIAM, N. Am. Fauna, No. 1, Oct., 1889, p. 25.

Two specimens, ♀ ad., skin with skull, and skin of a young specimen about two-thirds grown, Bee Co., Texas, April, 1887, J. M. Priour. Also ♀ ad., skin and skull, Padre Island, Nueces Co., Texas, Feb. 24, 1887, J. M. Priour.

These specimens were at first presumed to be *P. hispidus* Baird, but on comparing them with the type of that species, kindly loaned me for this purpose by the authorities of the U. S. National Museum, they prove to have no near relationship with that species. They are therefore provisionally referred to Dr. Merriam's *P. paradoxus spilotus*, based on specimens from Gainesville, Texas, though presumably different, Bee County and Gainesville being separated by nearly the whole length of the State of Texas, and are, furthermore, in very different faunal districts. The type being in Dr. Merriam's private collection, his absence in the field renders its examination for the present impracticable. Judging from his descriptions, measurements and figures of *P. paradoxus* and *P. paradoxus spilotus*, these specimens belong to the same group. While they seem to scarcely differ from the latter in coloration, they are much smaller, though two of them are fully adult (the female had evidently suckled young), as shown by the skulls. No. $\frac{3480}{2735}$ measures as follows:

Measurements (approximate from skin): head and body 91.5 mm.; tail vertebræ, 78.7; hind foot, 23; ear from crown, 8.

Skull: total length, 29.2; basal length (condyle to incisors), 22.9; greatest mastoid breadth, 14; least intermastoid breadth, 7.6. These measurements in *paradoxus* and *spilotus* are respectively as follows: 32, 31; 26.6, 25.2; 15.7, 14.5; 9, 8.6.

The Bee County specimens are thus more than one-tenth smaller than even *P. p. spilotus;* the fore limbs are not fulvous to the wrists (except partly so in the young specimen), while the lower surface of the tail is strong fulvous, like the flanks, instead of white or yellowish-white, as in *paradoxus* and *spilotus.*

## 28. **Dipodops compactus** (*True*).

*Dipodomys compactus* TRUE, Proc. U. S. Nat. Mus., 1888, p. 160. (Padre Island, Texas.)

Three specimens, Padre Island, Nueces Co., Texas, skins with skulls, Feb. 19–22, 1887, J. M. Priour. One of the specimens is very pale ashy gray above, apparently albinistic.

## 29. **Dipodops sennetti,** sp. nov.

Pattern of coloration as usual in the group. Above strong yellowish ochraceous-buff, very much mixed with blackish, the dark tint almost prevailing over the middle of the dorsal region from the crown to the base of the tail, lessening insensibly on the sides and passing into nearly unmixed strong buffy yellow on the flanks. Upper tail stripe dusky brown; the lower similar but paler, both extending the whole length of the tail. Lateral tail stripes white, continued considerably beyond the vertebræ. Tail slightly crested and penicillate.

Measurements (approximate from skin): Total length, 210 mm. (7.20 in); head and body, 100 (3.94); tail vertebræ, 110 (4.33), pencil, 20 (.79); hind foot, 35 (1.46); ear, from crown, 9 (.28), from anterior base, 13 (.51).

Skull, total length, 38.8 mm.; greatest width, 23.7; nasals, 13.6, as against, respectively, 41, 25.5, and 15 in *D. ordii*, and 26, 21.3, and 14 in *D. compactus.*

Type No. $\frac{3478}{2733}$, ♂ ad., near Brownsville, Cameron Co., Texas, March 9, 1888, J. M. Priour.

This form is nearest to *D. ordii*, which it much resembles in coloration, but is rather darker and less golden, the cheeks more mixed with blackish and the dusky eye ring broader, and the tail very differently colored. Compared with one of Dr. Merriam's El Paso specimens (No. $\frac{18142}{25040}$, U. S. Nat. Mus., kindly loaned me by the Department of Agriculture), forming one of the series of specimens from which Dr. Merriam recently redescribed* the

* N. Am. Fauna, No. 4, Oct., 1890, p. 45.

species, the following differences are to be noted. Besides the general difference in coloration already noticed, the tail in *D. sennetti* is broadly and continuously blackish both above and below, with the white lateral stripes sharply defined; in *D. ordii* the basal half of both the upper and lower surfaces of the tail is so much mixed with whitish as to produce a general grayish effect; the ears in *D. sennetti* are broadly edged with blackish on the outer anterior border, of which marking there is barely a trace in *D. ordii*. But these differences may be seasonal, the El Paso specimen having been taken in December and the Cameron County example in March. There is apparently but little difference in general size or proportions, except in the size of the ears, which are much the larger in *D. sennetti*. A comparison of the skulls, however, shows surprising differences. In *D. ordii* the skull is more triangular, the rostral portion being narrow, pointed and rather short, while the mastoid portion is greatly swollen. Just the reverse of this occurs in *D. sennetti*, the rostral portion being both elongated and broadened, while the mastoids are much less inflated and widely separated by an interparietal area three times as broad as in *D. ordii* and of an entirely different shape. The interparietal in *D. ordii* is subtriangular, and nearly three times broader at its anterior than at its posterior edge; while in *D. sennetti* the interparietal is slightly hour-glass shaped—quadrate, slightly hollowed on the lateral margins—with the anterior and posterior width about equal. The expanded orbital bridge of the maxillary is broader and much more developed in *D. sennetti* than in *D. ordii*. The lower jaw is also very different in the two species, in *D. sennetti* the condylar portion being much more depressed and the condyle itself longer and very different in form from the same part in *D. ordii*, while the angle is much broader and its plane less oblique to the vertical plane of the ramus.

*D. sennetti* differs from *D. compactus* in being about one-third larger (judging from the skulls), and in its very much darker coloration. In other words, *D. compactus* is a small, pale form, probably restricted to Padre Island.

**30. Tatusia novemcincta** (*Linn.*).—One specimen, Tampico, Mex., June 1, 1885, J. M. Priour.

**31. Didelphys virginana californica** (*Bennett*).—Three specimens, Corpus Christi and Brownsville, Texas, G. B. Sennett.

In general color specimens of the Opossum from the Lower Rio Grande are nearly black, the surface of the pelage being deep brownish black or black, the under pelage yellowish white.

ARTICLE XVI.—*Description of a New Subspecies of the Eastern Chipmunk, from the Upper Mississippi Region, West of the Great Lakes.* By EDGAR A. MEARNS, Assistant Surgeon, U. S. A.

Some months ago, when examining several specimens of the form of *Tamias striatus* here described, from Fort Snelling, Minnesota, certain peculiarities were noted in them, which led to their comparison with all of the specimens of this species available, including the series from the Museum of Comparative Zoölogy at Cambridge, as well as those in the American Museum. In order to ascertain whether the differences observed were constant, rather than accidental, an especial effort was made to procure additional specimens, which has resulted in a collection of thirty-five specimens, all obtained by the writer. Of these, thirty-two were taken at Fort Snelling, Minnesota, the point where the Mississippi is joined by the Minnesota River; and the remaining three came from the Lemonweir River, in Juneau County, Wisconsin, a stream which reaches the Mississippi through the Wisconsin River. The season during which these specimens were taken extends from April 2 to October 20, all of the intervening months but June being represented.

Through the kindness of Dr. J. A. Allen, of the American Museum, I have received the specimens of the *Tamias striatus* group, in the collection of that institution, for comparison with my own. This material comprises typical specimens of the northeastern race, *Tamias striatus lysteri*,* from Lake Umbagog, Maine, Rutland and Castleton, Vermont, the Catskill Mountains and Lewis County, New York, and Toronto and Lorne Park, Ontario, Canada, the last (three specimens collected by Mr. Ernest E. Thompson) of special interest as representing the type locality. All of the specimens from the lower Hudson—from West Point to New York—all from New Jersey, and all from Long Island, except a single specimen from Rockaway, are *striatus*, but do not exhibit its strongest characters, as expressed in examples from the

* Originally described by Richardson, from Penetanguishene, on the northeast arm of Lake Huron, but never recognized as subspecifically distinct from *Tamias striatus*, until so described by Dr. C. Hart Merriam (American Naturalist, XX, 1886, p. 236), who restored Richardson's name, as specimens from the region of the type locality were known to belong to the northeastern race (*lysteri*).

type locality—Virginia and the Carolinas. Massachusetts is an interesting neutral ground, furnishing specimens of both subspecies, more or less intermediate; those from Sheffield and Rehoboth, though clearly referable to *lysteri*, verge towards *striatus*, while those from Newton are intermediate between *lysteri* and *striatus*. Examples from Providence, Rhode Island, are *striatus*, but show an approach, both in measurements and color, to *lysteri*. A specimen from Erie, Pennsylvania, collected by Mr. Frank M. Chapman, is *lysteri*, but not reflecting its highest state of development; and six specimens from Ravenna, in northeastern Ohio, also near Lake Erie, are likewise to be referred to *lysteri*, but are more heavily colored than the last, and are much suffused with ferruginous yellow. Michigan specimens are likewise *lysteri*, and present slight local peculiarities of coloration, but in the main agree with those from Ohio.

Upon separating the above enumerated specimens of the two recognized subspecies, *striatus* and *lysteri*, and comparing the Fort Snelling series with them, a strong disagreement is found in each case. As coming from so high a latitude, and being of large size, they are naturally to be compared with *lysteri*, but their dark coloring, strong markings, stout 'build' and scant hairiness below, combine to form a striking contrast with that race, and it is found that it will bear a much closer comparison with *striatus*, especially as regards coloration. Like the latter, the body is stout and heavy, and the hands and feet broad in proportion to their length. It is probably the largest and heaviest of all the Chipmunks of this group. Though the feet are disproportionately broad, they measure in length fully as much as the largest examples of *lysteri*, two of the eleven adults measured reaching 38 mm., a size probably never exceeded by *lysteri*. Its general coloring closely resembles that of northern specimens of *striatus*, such as are before me from northern New Jersey and the lower Hudson Valley; but it is readily distinguished from them by the absence of the strong fulvous tinge of the sides, and of the castaneous of the rump, by the clearer iron-gray above, the greater posterior extension of all the dorsal stripes, and coincidently of the gray bands bordering the median line at either side of the central black stripe; the white stripes are

broader, longer, and clearer white, and the central black stripe often reaches the root of the tail. The under side of the tail is pale buffy fulvous instead of deep hazel. In spring specimens the admixture of gray on the rump is a conspicuous point, in connection with the absence of the chestnut from that part. It may also be recognized by the coarseness and scantiness of the hair, and by the greater size of the feet, as well as of the body generally.

## **Tamias striatus griseus,** subsp. nov.

*Habitat.*—Upper Mississippi Valley, west of the Great Lakes.

*General Characters.*—A large, stout, grayish, interior race, in which the fulvous and ferruginous tints are much subdued, and the black markings rather pronounced.

*Spring Pelage* (based on two adult females—Nos. 2196 and 2197, Am. Mus. Coll.—taken April 2 and 13, which contained, respectively, five and four fœtuses, and a female—No. 3601, Am. Mus. Coll.—taken May 5, which is closely similar to the April specimens, it having recently undergone parturition). Pattern of markings as in *Tamias striatus.* Above mixed gray and black, giving an iron-gray tone, which is tolerably clear from the occiput to the middle of the back, whence posteriorly it is somewhat obscured by an admixture of light chestnut-rufous hairs, as is also the case on the forehead. The black stripes are sharply defined, but fade to a light chestnut posteriorly, except the central one, which commences as a black line at the occiput and extends, though indistinctly behind, to the root of the tail. The white stripes begin opposite the fore part of the shoulder, and are traceable to the root of the tail, though stained with ferruginous posteriorly. There is an inconspicuous admixture of light yellow tips to the hairs above, which extends over the sides as a distinct wash overlying the otherwise pale gray of the sides of the head and body and outer surface of the limbs, this light yellowish gray deepening to pale rusty on the hinder extremities. These parts are but slightly mixed with black hairs ; but the grayish color of the sides is somewhat heightened by the gray underfur, which darkens to plumbeous on the back. The ears are quite pointed, densely clothed with rufous hairs on their inner surface, this color passing around the anterior border and forming a narrow band on the outer surface, which has a tricolored pattern, the front border being rufous, the posterior border pure white, and the triangular interspace dusky plumbeous. The dark spot at the base of the nose and behind the eye, and the stripes on the sides of the head, are rather well defined. The whiskers are long and black. The color of the sides fades insensibly into the clear white of the underparts, upon which the hair is coarse, and so scanty as to permit the skin to be seen through it ; but the soles of the feet are well clothed as far as the tubercles. The upper surface of the manus is white, faintly washed with yellow, the pes being yellowish above, fading to whitish on the toes, and

with a dusky stripe below. The upper surface of the tail is dark ferruginous at the base, more or less grizzled and mixed with black, thence black, mixed with pale buff centrally, and hoary externally, the lateral hairs being buff or fulvous at base, narrowly ringed with black, with hoary tips, those of the upper surface being black, banded with buff in the middle, with slight hoary tips. The under surface varies from pale buff to fulvous, usually becoming darker towards the extremity.

*Summer Pelage.*—A nursing female, in very shaggy, worn coat (No. 3602, Am. Mus. Coll.), taken at Camp Douglas, Wisconsin, July 16, is molting, the change of coat having begun at the nose and progressed backward nearly as far as the ears. The new hairs are so broadly tipped with yellow as to conceal the darker, castaneous tone seen in spring specimens, the color being slightly olivaceous. Otherwise, aside from a general fading, it is like spring examples. A male (No. 3603, Am. Mus. Coll.), taken at the same place on August 24, has completed its molt throughout. Its markings, instead of appearing clear and bright, as might be expected after acquiring a new coat, are everywhere obscured by the yellow tips, as observed on the head of the July specimen ; but in this specimen the color, which is more olivaceous still, is strongest on the posterior portion, where the fresh coat was latest acquired, while upon the forehead the usual color is being restored by the wearing away of the olive-yellow tips to the hairs. The general coloration differs but little from that of spring specimens.

*Fall Pelage.*—Seven adults, of both sexes, taken at Fort Snelling, from September 22 to October 4, are all in completed fall pelage, the coat having been worn long enough to take off most of the olive-yellow wash. They vary but little among themselves, and do not differ much from the early spring coat, though somewhat brighter, with a little more rusty or castaneous about the crown and rump. The underparts are white, and but little more densely coated than in the spring specimens.

*Young.*—In the youngest example before me (No. 780, Mearns Coll.), a female taken July 5, the head and body measured 140 mm. Aside from the usual wooliness of young mammals generally, there is little variation from spring specimens to note, save that it is of a slightly lighter color. A young male of the year (No. 3604, Am. Mus. Coll.) taken at Camp Douglas, Wis., on August 24, was closely similar to the adult male (No. 3603, Am. Mus. Coll.) above described, taken the same day, at the same place. It is strongly washed with yellowish. A dozen specimens, all young of the season, from Fort Snelling, taken from September 21 to October 20, show considerable variation in size, according as they were born early or late in the season. Young of the year, when examined in the flesh, at this season, may be readily distinguished by their narrow, stringy tails, as compared with the more bushy member of adults, though some are scarcely inferior in size. The hair is also shorter and much finer, producing a finer blending of colors ; and the under side of the tail is usually paler. The young do not otherwise present any appreciable difference from adults at the same

season. Six fully grown females were taken late in autumn, which were classed as immature, having never borne young, and three males, after an examination of their skulls, were placed in the same category; these are probably young of the preceding year.

*Dimensions* (average measurements of eleven adults, three of which were males, and eight females, all of the latter having borne young; measured in the flesh by the author).—Length, measured from nose to end of vertebræ of tail, 261; head and body, measured from nose to tuberosity of ischium, 166; tail, from root to end of vertebræ, 103; tail, from root to end of hairs, 124; width of tail outspread, 42; height of ear from crown, 12.6; height of ear from notch, 19.9; width of ear, 14.7; girth of chest, 90; distance between eyes, 20.5; diameter of eye, 6; length of longest whisker, 32; from tip of nose to eye, 18.5; to centre of pupil, 23.1; to auditory meatus, 36.8; to tip of ear, 53; to occiput, 45.3; to end of outstretched hind limb, 244; length of fore limb, measured from coracoid process to end of longest claw, 61; from olecranon to end of claws, 46; length of manus, 23; width of manus, 6.8; longest claw of manus, 4.2; length of hind limb, measured from great trochanter to end of claws, 88; from knee-joint to end of claws, 65; length of pes, 36.3; width of pes, 8.1; longest claw of pes, 4.4 mm.

Type, No. 2196, Am. Mus. Coll., ♀ ad., Fort Snelling, Minnesota, April 2, 1889, Dr. Edgar A. Mearns.

*Cranial and Dental Characters.*—In this subspecies we have the largest and heaviest skeleton of the *Tamias striatus* group. The skull, measured from the posterior border of the occipital condyle to the end of the nasals, averages 2 mm. longer than the largest specimens of *lysteri* before me. Though the skull of *lysteri* is relatively less in its parietal, interorbital and zygomatic breadth, the molar series of teeth are more widely separated than in *griseus*, and have a greater posterior convergence, the rows being more nearly parallel in *griseus*. The infra-orbital foramen is much larger in *lysteri* than in *griseus*. The heavier ossification of *griseus* is most apparent when the mandibles are compared. They are much larger and rougher for the muscular attachments, with strikingly larger condyles than in *lysteri*, from which it also differs in having the lower outline of the jaw much more concave, owing to the relatively greater development of the angular process, which is produced downwards and backwards. In general, the skull bears a closer resemblance to that of *striatus* than it does to *lysteri*, but differs notably from the former in its considerably larger size.

ARTICLE XVII.—*Description of a New Species of Weasel, and a New Subspecies of the Gray Fox, from Arizona.* By EDGAR A. MEARNS, Assistant Surgeon, U. S. A.

## **Putorius arizonensis,** sp. nov.

(ARIZONA WEASEL.)

*Habitat.*—Mountains and high plateau region of Arizona, down to the lower limit of the forest zone of *Pinus ponderosa.*

*General Characters.*—This is one of the smaller Weasels, its skull being but little larger than that of *Putorius vulgaris* from England. The general effect of its coloration is similar to that of *P. longicauda*, though approaching the deeper tints of *P. brasiliensis xanthogenys.*

*Summer Pelage* (based on the type specimen, a nursing female, taken June 20, 1886*).—Above yellowish mahogany-brown, deepening to chocolate-brown on the front of the head; tail with terminal black pencil; below tawny-yellow, becoming paler on the inner surface of the limbs, and shading to white on the hind toes and on the whole of the manus; throat and border of upper lip white; tail of the same color as the upper surface, but paler towards the base below; whiskers mixed black and white, the longest measuring 33 mm. in length; no trace of a white spot between the eyes, nor of a dark spot near the angle of the mouth. There are a few white hairs in the nape.

*Fall Pelage* (No. 2489, Am. Mus. Coll., ♂ ad., Quaking Asp Settlement, Mogollon Mountain Divide, Yavapai Co., Arizona, Sept. 20, 1887, collected by Dr. Mearns).—Similar to the above, but with more tawny-yellow staining on the feet, and a more olivaceous shade above. The white spot between the eyes, seen in *xanthogenys*, is suggested by a minute white spot, and the dark blotch at each side of the head, behind the angle of the mouth, sometimes seen in *longicauda*, and conspicuous in *xanthogenys*, is likewise indicated.

*Measurements of Type* (taken in the flesh by the author).—Length, measured from nose to end of caudal vertebræ, 302 (to end of hairs of tail, 323); head and body, measured from nose to tuberosity of ischium, 198; tail, from root to end of vertebræ, 109; tail, from root to end of hairs, 130; height of ear above crown, 11; height of ear above notch, 19; width of ear, 17; from tip of nose to eye, 14; to ear, 30; to auditory meatus, 35, to tip of ear, 49; to occiput, 45; to end of outstretched hind limb, 275; distance between eyes, 13; girth of neck, 65; girth of chest, 78; girth of abdomen, 88; girth of loin, 70; fore limb, measured from coracoid process to end of longest claw, 63; from olecranon to end of claws, 44; length of manus, 22; longest claw of manus, 4.3; hind limb, measured from great trochanter to end of claws, 77; knee-joint to end of claws, 56; length of pes, 32; longest claw of pes, 4 mm.

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* A memorandum of the colors was made before skinning, the specimen having been subsequently preserved in a solution of alum and salt, which extracted much of the coloring matter.

*Cranial Characters.*—The only skull before me is that of the type (No. 1886, Am. Mus. Coll.) which, fortunately, is perfect, and adult, the sutures being closed and obliterated; but, from the perfect condition of the teeth, and the absence of prominent bony ridges, it is probably but middle aged. The animal was nursing young at the time it was taken. It is most closely related to *Putorius brasiliensis xanthogenys*, *P. b. frenatus*, and *P. longicauda*, from which its small size at once distinguishes it, it being less than half the size of either of them, as regards bulk and weight, the skull measuring but 35.3 mm. in basilar length by 22 mm. in zygomatic breadth. With the single specimen in hand, and an insufficient series of skulls of the remaining species of the genus from which to prepare reliable *average* measurements and ratios for comparison, it is impossible, as yet, to give a sufficiently exact account of the cranial and dental characters of this species. It appears to present no very salient points of difference from the forms above named, though the palatal notch is a little shallower, and the audital bullæ slightly more developed. The height of the mandible, as compared with its length, is a little less than in those species, but greater than in *vulgaris*, *cicognani*,* and *erminea* from the Eastern United States. Its proportions are nearest to the two northern subspecies of *brasiliensis*, in which the brain-case is relatively broader, as compared with the basilar length of Hensel, than in *longicauda*, and considerably broader than in any other American species of the genus—taking the genus *Putorius* in a wide sense, to include *Cynomyonax* and *Lutreola*—*arizonensis* having the brain-case broader than *longicauda*, equaling *frenatus*, and appreciably narrower than *xanthogenys*. The zygomatic breadth is relatively less than in any of the remaining North American species except *cicognani* and *erminea*. The ratio of the two measurements, from the posterior border of the foramen magnum to the hinder margin of the palate, and from the last point to the front incisor teeth, is, in *arizonensis* 54:46, in *xanthogenys* 53:47, in *frenatus* 58:42, in *longicauda* 53:47, in *erminea* (from the Eastern United States) 55:45, in *cicognani* 58:42, in *vison* 48:52, in *nigripes* 51:49. No saggital crest is developed in this specimen, and it is probable that it will prove to be inconspicuous in this species, the skull as a whole being lightly ossified.

Type, No. $\frac{2490}{1886}$, Am. Mus. Coll., ♀ ad., San Francisco Forest, Yavapai County, Arizona, June 20, 1886, Dr. Edgar A. Mearns.

* The species provisionally referred to this form is a very slender Weasel, from Fort Snelling, Minnesota, represented in my collection by five specimens, which are very distinct from *erminea* and *vulgaris*, both of which have representatives in this region. Its size and proportions are nearer to Bonaparte's diagnosis of this species, as elaborated by Professor Baird, than to the same author's "*M. richardsoni*," which has a longer tail. These specimens averaged 218 mm. in length of head and body, with the caudal vertebræ 80 mm., and the pes 40 mm. The furry coat is short and quite harsh, as compared with the small Weasels of the East, and differently colored, the color being chocolate-brown, becoming much darker on the fore part of the head, which has the upper lip indifferently white or dark, or a mixture of both. The feet are mostly colored like the upper surface, and the underparts nearly pure white, there being no staining of the upper or under surface with yellow. End of tail black.

## **Urocyon virginianus scottii,** subsp. nov.

(Scott's Fox.)

*Habitat.*—Southern California, Arizona, and Western New Mexico.

*General Characters.*—Similar in general size and pattern of coloration to *Urocyon virginianus*, but more slender, with very much longer ears and tail, with the muzzle more attenuated, and the colors paler, purer gray, and more yellowish fulvous.

Type, No. $\frac{1343}{588}$, ♂ nearly adult, Pinal County, Arizona, October 28, 1884; collected by W. E. D. Scott.

*Description of Type.*—About the size of *U. virginianus*, but more slender, with much longer tail, and much longer and more pointed ears; upper surface a fine, hoary gray, the underfur being gray, the long coat black with broad white or silver-gray subterminal annulations; towards the sides the black area on the long hairs gradually decreases, and, in consequence, the color becomes paler and grayer; whole of lower jaw black, curving around the commissure and extending forward as a narrow marginal band as far as the whiskers, where the whole sides of the muzzle become black (as are the whiskers), excepting a small white spot adjoining the nasal pad; lower half of face, inner surface of ears, throat, a large patch on the breast and another on the belly, pure white; convexity and base of ears, sides of neck (meeting to form a gorget), edge of belly, and hinder surface of limbs, yellowish fulvous, darkest on the base of the ears; fore limbs with a hoariness extending from the middle of the humerus to the feet; chest and inner sides of limbs stained with fulvous; tail gray, with a broad stripe of pale yellowish fulvous below, and a narrow stripe of black above, formed by the so-called 'mane' of stiff hairs in the median line.

*Measurements.*—No. 472, Mearns Collection,* ♂ ad., near Fort Verde, Yavapai County, Arizona, November 22, 1886: Length, measured from nose to end of caudal vertebræ, 985; head and body, 585; tail from root to end of vertebræ, 405; to end of hairs, 475; greatest expanse of tail, 200; girth of chest, 290; height of ear from notch, 78, above crown, 83; width of ear, 75; distance between eyes, 31; diameter of eye, 15; length of longest whisker, 90; from tip of outstretched fore limbs to that of outstretched hind limbs, 925; from tip of nose to front incisor teeth, 16; to angle of mouth, 67; to eye, 59; to centre of pupil, 68; to ear, 118; to tip of ear, 212; to occiput, 146; to end of outstretched hinder extremity, 905; fore limb from coracoid process of scapula to end of claws, 267; from olecranon, 192; length of manus, 94; width, 32; hind limb from great trochanter to end of claws, 350; from knee-joint, 240; length of pes, 132, width, 32; weight, 8¼ pounds Avoir. Iris hazel.

No. 664, Mearns Collection, ♀ ad., Copper Cañon, Verde Mountains (near Forte Verde), Arizona, February 10, 1888: Length, measured from nose to

* Measured in the flesh by the author; still in a preservative fluid, and not yet catalogued in the American Museum Collection.

end of caudal vertebræ, 1,105; head and body, 630; tail, from root to end of vertebræ, 470; to end of hairs, 545; breadth of expanded tail, 190; girth of chest, 250; height of ear from notch, 84; above crown, 92; width of ear, 80; distance between eyes, 30; diameter of eye, 15; length of longest whisker, 97; from tip of nose to front teeth, 14; to angle of mouth, 68; to eye, 59; to centre of pupil, 69; to ear, 123; to tip of ear, 225; to occiput, 148; to end of outstretched hind limbs, 950; fore limb from coracoid to end of claws, 275; from olecranon, 203; length of manus, 95; width, 30; claws, 11.5, 15, 14, 14, 13.5; hind limb from great trochanter to end of claws, 355; from knee-joint, 220; length of pes, 135; width, 28; claws, 13, 13, 13, 13.

Average measurements of three adult males of *Urocyon virginianus*, from the Hudson Highlands, New York, taken by the author, and measured in the flesh: Head and body, 642; tail from root to end of vertebræ, 333; to end of hairs, 437; breadth of expanded tail, 229; height of ear above crown, 77; from tip of nose to eye, 54; to ear, 117; to occiput, 143; fore limb from olecranon to end of claws, 190. Iris grayish brown.

*Cranial Characters.*—The produced muzzle and slender frame of this Fox as compared with the shortened muzzle and stouter build of the eastern animal, should, it would seem, find expression in pronounced cranial characters; but I have examined the half-dozen skulls before me without being able to fix upon a single diagnostic character, skulls from New York differing more among themselves than they do from Arizona specimens; but there are *average* differences between specimens from the two regions; but, to define them with precision, larger series of specimens are required.

*Remarks.*—There is considerable variation in the intensity of the fulvous markings in the six skins examined, the brightest one having been taken in February. The contrast of these markings with the beautiful silver-gray of the upper surface is very pleasing, the pelts being handsomer by far than those of the Eastern Gray Fox, and highly prized by the Indians. All of these specimens differ from eastern ones in having all of the underfur gray, except upon the forehead where it has a faint fulvous tinge, whereas eastern specimens are quite strongly tinged with fulvous over the whole upper surface, though the hairs are plumbeous at the extreme base. The Arizona animal is paler, clearer gray above, with the fulvous markings yellowish instead of chestnut-fulvous. The tail is differently colored in the two animals, that organ being distinctly tricolored in *V. scottii*—gray, striped with black above and yellowish fulvous below; while in *V. virginianus* the gray color of the sides of the tail is largely mixed with rufous,

especially towards the extremity, where the hairs are only black for their terminal three-fifths.

Scott's Fox is distinguished by the great size of its ears, which measure 11 mm. more in height than those of *U. virginianus;* also by the greater length of its tail, the caudal vertebræ averaging 105 mm. more in length than in the eastern species, which is stouter, with relatively shorter limbs and heavier body. The differences noted between the Eastern Gray Fox and the present subspecies have a close parallel in the case of *Vulpes velox* and *V. macrotis.* In *V. velox*, the Eastern Kit Fox, the body is stout, with short ears and tail; while in *V. macrotis*, which inhabits Southern California and Arizona, the ears are much enlarged, the tail elongated, and the form slender. In external appearance Scott's Fox differs as much from the Eastern Gray Fox as *V. macrotis* does from the Eastern Kit Fox; but the well-marked cranial characters which serve so well to distinguish the latter species from each other are absent in the Gray Foxes; or, rather, the variations are so great in skulls from a single locality that the average differences between specimens from the two regions are overlapped by exceptional individuals in either.

Skulls of a Gray Fox from Nicasio, California, collected by Mr. C. A. Allen, agree essentially with those from Arizona; and Mr. D. G. Elliot procured a specimen of Scott's Fox in the San Francisco Mountains of New Mexico. Its range, therefore, extends from Southern California across Arizona into western New Mexico.

ARTICLE XVIII.—*Observations on the North American Badgers, with Especial Reference to the Forms found in Arizona, with Description of a New Subspecies from Northern California.* By EDGAR A. MEARNS, Assistant Surgeon, U. S. A.

From my field observations, and an examination of the specimens in the American Museum collection, it appeared that two very different Badgers inhabit Arizona. One of these is found in the low, semi-desert region of the Territory, which is characterized by the Sonoran fauna and flora, the other in the plateau and mountain region. At Fort Verde, in the Upper Sonoran area, having an altitude of about 3300 feet, the ranges of these two overlap each other. The naturalists of the Wheeler Survey long since noted the presence of two forms of the Badger in Arizona and New Mexico. The southern Badger at large, in its range from Texas to Lower California and southward, has always been known as the *Taxidea berlandieri* of Baird, described from figures, MS. descriptions, and skulls in the Berlandier collection, from Matamoras, Mexico. Later systematic writers have reduced the form to the rank of a subspecies, making it *Taxidea americana berlandieri*. As the Arizona specimens were all clearly referable to one or the other of two forms, and, as the ranges of these two touched and even overlapped in places, the probability of their being specifically distinct from each other was suggested; and doubts were entertained as to the identity of the Badger of the Sonoran Fauna with that of the Tropical Fauna of Eastern Mexico, or typical *T. berlandieri*.

Through the courtesy of Mr. F. W. True, of the United States National Museum at Washington, I have been able to compare Arizona specimens with Professor Baird's types (skulls) of *T. berlandieri*, and to examine the fine National Museum series of Badgers. Dr. J. A. Allen has also kindly permitted me to use the specimens in the American Museum collection, so that the total material at my command is greater than that examined by preceding writers, but is, nevertheless, totally insufficient for the determination of the geographical forms of this animal; and, until better and more extensive material is available for study, the Badgers from such widely different regions, faunally and geographically, as Lower California, Sonora, Arizona, and Eastern

Mexico, are, in my judgment, best left as they are—*Taxidea americana* standing for the northern Badger, and *Taxidea americana berlandieri* for the southern.

Though unable to arrive at definite or satisfactory conclusions, I will present the results of my investigation, in the hope that they may prove of use to future students of the American Badgers.

*Specimens examined*, 32, as follows: **Minnesota,** Grant Co., 1877, J. N. Sanford (Am. Mus., No. 1473, ♀ ad., skin and skull). **Iowa,** Quasquiton, E. C. Bedwell (Nat. Mus., No. 2078, skull). **Dakota,** Valley of White River, Upper Missouri, Dr. Hayden (Nat. Mus., No. 2148, skull); near Snatch Creek, June 8, 1864, S. M. Rothhammer (Nat. Mus., No. 6602, skull); Fort Lincoln, Nov. 20, 1889, Herman Luerssen (mounted); Ft. Randall, Jan., 1873, Dr. E. Coues (Nat. Mus., No. 12,908, skull). **Nebraska,** Republican Fork, Platte River, Sept. 28, 1856, W. S. Wood (Nat. Mus., No. $\frac{2572}{1874}$, ♂); Loup Fork, Platte River, F. V. Hayden (Nat. Mus., No. 3456, skull); Platte River, F. V. Hayden (Nat. Mus., No. 3457, skull); Ft. Bridger, C. S. McCarthey (Nat. Mus., No. 3656, skull). **Kansas,** Nat. Mus., No. 21,771, skull, from Army Med. Mus. **Wyoming,** Bridger's Pass, W. S. Wood (Nat. Mus., No. 3322, skull); F. V. Hayden (Nat. Mus., No. 11,565, skull). **Utah,** Salt Lake Region, Capt. Sternberg (Nat. Mus., No. 2164, skull); Bridger, F. Hirst (Nat. Mus., No. 15,693, skull). **Oregon,** Upper Des Chutes, J. G. Cooper (Nat. Mus., No. 2033, skull). **California,** Ft. Crook, John Feilner (Nat. Mus., No. $\frac{4196}{3832}$, ♂); El Cajon Valley, C. R. Orcutt (Nat. Mus., No. 23,529, skull). **Lower California,** Cape St. Lucas, John Xantus (Nat. Mus., No. 4135, skull). **Arizona,** Springerville, Apache Co., E. W. Nelson (Nat. Mus., No. 15,044, skin); Pinal Co., Oct. 25, 1884, W. E. D. Scott (Am. Mus., No. $\frac{1345}{590}$, ♀); Ft. Verde, Yavapai Co., E. A. Mearns, Aug. 30, 1885 (Am. Mus., No. $\frac{2496}{1935}$, ♀); Oct. 12, 1885 (No. 260 Mearns Coll.; Am. Mus., No. ——?, ♂ ad., skin); Feb. 3, 1888 (Am. Mus., No. 1936, ♂, skin and skull). **New Mexico,** Dr. J. S. Newberry (Nat. Mus., No. $\frac{3655}{3766}$, skin and skull); Nat. Mus., No. 376, skull; Cantonment Burgwyn, Dr. Anderson (Nat. Mus., No. $\frac{22935}{4158}$). **Mexico,** Matamoras, Dr. L. Berlandier (Nat. Mus., Nos. 1389 and 1390, skulls). **Unknown localities,** Nat. Mus., No. 21,777, skull, from Army Med. Mus.; No. 13,889, skull, collected by Dr. E. Coues; No. 23,037, skull.

*External Characters.*—In comparing Arizona Badgers, a specimen from Fort Verde may be considered a typical representative of the Sonoran faunal province, while one collected by Mr. Scott in Pinal County, Arizona, represents the northern species, which extends its habitat southward along the mountains and high plateau region. A detailed description and comparison of these two specimens is a necessary preliminary to more extended comparisons:

No. 2496, Am. Mus. Coll., ♀, nearly adult,* August 30, 1885, Fort Verde, Arizona; collected by E. A. Mearns.—Above grayish brown, with a continuous white dorsal stripe, broad in front and narrow posteriorly, extending from nose to root of tail; white stripe occupying one-third of space between eyes (measuring 25 mm. at widest point), and broadly bordered on either side with brownish black before; the two black bands united in front and extending to the edge of the upper lip, encircling the nasal pad, involving the eye on each side, fading to brownish on the occiput, and gradually grizzling to the color of the back; feet and lower part of limbs, and a large triangular patch in front of ear, black, the latter joined to the black area surrounding the eye, forming an isthmus which separates two whitish patches on the sides of head which are broadly united in the northern Badger; convexity of ears black throughout, this color extending onto the opposite surface at the posterior root, where it forms a conspicuous black spot, the rest of the inner surface being white, as is a narrow stripe in front of the ear, bordering the triangular black patch; sides of face, a triangular postorbital spot, throat and much of lower jaw, very pale clay-color; long hairs of back, clay-color or ochraceous buff, with a subterminal band of dark brown, and hoary tips; coating of hairs still longer on sides, where the grayish tips are broader, and the yellowish ground color more exposed; upper surface of tail lacking the annulations of blackish brown except near the base, but with the extreme tip of tail blackish, the hairs pointed with gray; below with a white band extending from the point of the chin to the anus, corresponding to the white dorsal stripe, the two together dividing the animal into lateral halves; this stripe broadly bordered by brownish black on the chin, and interrupted by a small black spot in the median line opposite the angles of the jaw; rest of under surface, including under side of tail and inner aspect of thighs, ochraceous buff, becoming clay-color on the throat; claws, horn-color; iris, grayish brown; nasal pad, black; under surface of feet, dusky, the folds between the pads flesh-color.

*Measurements* (taken from the fresh specimen by author): length to end of caudal vertebræ, 650; head and body (measured from nose to tuberosity of ischium), 530; tail to end of vertebræ, 120, to end of hairs, 165, girth of neck, 295, of chest, 340, of abdomen, 445; distance between eyes, 39; distance between angles of mouth, 42; from front incisor teeth to angle of mouth, 37; width of nasal pad, 22; height of ear above meatus, 55; width of ear, 47; from tip of nose to eye, 57, to centre of pupil, 63, to ear, 80, to auditory meatus, 112, to tip of ear, 153, to occiput 160, to end of outstretched hinder extremity, 705; fore limb, from olecranon to end of longest claw, 189; length of manus, 102; width, 48, claws, 28, 32, 33, 31, 28; hind limb, from patella to end of longest claw, 155; length of pes, 104, width, 42, claws, 12, 14, 16, 19, 14.5; expanse of fore limbs, across shoulders, 570; expanse of outstretched hind limbs, 517 mm.

No. 1345, Am. Mus. Coll., ♀, nearly adult, October 25, 1884, Pinal County, Arizona; collected by W. E. D. Scott.—Above brownish gray, becoming sandy

* Probably young of the preceding year. It has the mature dentition, and the cranial sutures closed but not obliterated, in these respects, as also in sex, agreeing with Scott's specimen, next described, which was taken about two months later in the season.

on the sides, where the subterminal annulations are obsolete; with a narrow band of white beginning about 20 mm. behind the nasal pad, extending backward in the median line and ending on the nape; black band on either side of this, not extending to the lips, but, commencing at the sides of the nose, extending backwards, sending off a triangular projection that forms a narrow black edging to the eye, and, becoming grizzled above the ears, fades to the general color of the upper surface at the occiput; lips, chin, throat, sides of head, and inner surface of ears, white; black of convexity of ears reduced to a narrow edging, which only appears as a small tuft invading the opposite surface near the posterior root; black triangular patch on side of face small in size, and separated from the orbital black by the white cheek-patch, which is broadly joined to the postorbital white spot; tail, ochraceous buff, tinged with tawny above, with the terminal pencil broadly banded with brownish black; below white, tinged with clay-color, deepening to ochraceous buff on gular region, shoulders, inner surface of thighs and under side of tail; chest and fore part of abdomen with a pure white median band; chin markings obsolete, but with a very small median black spot opposite angles of jaw; feet and lower part of limbs, black; long hairs of upper surface of body banded sub-basally with grayish drab; claws, horn-color. The size appears to be about the same as that of the preceding specimen, from Fort Verde.

The differences in external characters between the two specimens above described, are thus antithetically expressed:

| *Taxidea americana* (No. 1345). | *Taxidea a. berlandieri* (No. 2496). |
|---|---|
| Ears and tail short. | Ears and tail longer. |
| Upper surface of body brownish gray. | Upper surface of body grayish brown. |
| Longitudinal white stripes non-continuous, above and below. | Longitudinal white stripes, above and below, continuous from front of head to root of tail. |
| Markings light. | Markings heavy. |
| Hairs of upper surface of body banded sub-basally with grayish drab; and with a dense growth of soft underfur. | Hairs of upper surface of body without sub-basal bands, and without underfur. |
| Caudal pencil slightly banded with brownish black. | Caudal pencil brownish black. |
| Outer surface of ears merely bordered with black, with a small tuft of black appearing on inner surface near posterior base. | Outer surface of ears wholly black, a large black spot invading the inner surface at base of posterior root. |
| Black patch on side of head, small, and cut off from other black markings by white areas which entirely surround it. | Black patch on side of head largely continuous by its upper angle with the dusky markings of the top of the head, and with the black of orbit in front, dividing the whitish cheek-patch into two triangular areas—a small postorbital, and larger suborbital one. |
| Under side of head white, with markings obsolete. | Under side of head clay-color, with white and black markings. |
| Upper lips white in front. | Upper lips black in front. |
| Under surface of body principally white. | Under surface of body principally ochraceous buff. |

Comparing the Scott example of *T. americana*, from Pinal County, Arizona, with an old female from Minnesota (Am. Mus. Coll., No. 1473, Grant Co.; collected by J. N. Sanford), they are found to be closely similar in general coloration and in the relative size of the parts, though the Minnesota animal greatly exceeds the one from Arizona in size, the hind foot measuring 107 mm. in the former against 87 mm. in the latter; but a part of this difference is doubtless due to the greater age of the northern specimen. The difference in coloration mainly consists in the still paler tints of the Minnesota animal, the black markings being still more restricted, there being very little black on the ears, the black spot on the side of the head smaller, the lateral stripes on the forehead scarcely encircling the eyes, and ending opposite the ears, and dark markings entirely absent from under side of head. The white dorsal stripe is narrower, interrupted at a point between the eyes, ending at the nape. The whole under parts, except the tail, white. The feet are decidedly brownish instead of glossy black. There is scarcely any indication of a dusky tip to the tail. There is considerable woolly underfur, and the hairs of the upper parts have a broad zone of drab-gray near the base. On the whole the differences are slight.

A skin from Springerville, Arizona (Nat. Mus., No. 15,044, ♀; collected by E. W. Nelson), apparently in winter coat, and referable to *T. americana*, is essentially like Mr. Scott's specimen, with which it agrees in size. It also closely resembles the Minnesota specimen, having a very narrow white dorsal stripe which ends at the nape, with the black stripes of the head more restricted than usual, terminating abruptly opposite the ears. The coloring of the upper surface of the body is exactly like that of the Minnesota skin; but the under surface differs in having a creamy tint instead of being pure white. The gular band of the Scott specimen, which may have been the remains of a darker summer coat, is very faintly indicated in this one; and the chin and throat differ from it in being buffy instead of pure white.

Two specimens of *T. americana*, obtained at Fort Verde, Arizona, agree in the main with those collected by Messrs. Scott and Nelson; but one or two others from that locality agree with the specimen of *T. berlandieri* first described.

A specimen of *T. berlandieri* (Nat. Mus., No. 4158), collected by Dr. Anderson, at Cantonment Burgwyn, New Mexico, is almost exactly like No. 2496, from Fort Verde, except that the vertebral stripe is interrupted, and does not reach the rump. The white vertebral stripe is a quite variable character, upon which too much stress should not be laid, it being one of those 'group marks' in which the tendency to vary is well illustrated by the genus *Mephitis*.

Badgers from the Missouri region are similar to the Minnesota specimen, but are characterized by an intense hoariness and absence of tawny shades, resulting in a sharper contrast between the dark and light areas. A specimen from Fort Lincoln, Dakota, has the white dorsal stripe as wide as in the Fort Verde specimens of *berlandieri*, but ending on the nape.

A specimen from Fort Crook, California, collected by Mr. John Feilner (Nat. Mus., No. $\frac{4196}{3835}$, ♂), represents a new subspecies, to be described beyond. Like many animals of that region, it is characterized by an increased intensity of ochraceous and tawny tints in its coloration.

In the above comparisons of the northern Badger with the Sonoran form of *T. a. berlandieri* found in Arizona and New Mexico, certain constant differences are noted in the latter, such as the heavier coloration, tendency to have a continuous vertebral stripe, longer tail, larger ears, absence of underfur and sub-basal banding of the gray-drab to the hairs of the upper surface, in none of which particulars is there any indication of intergradation between the two, except with regard to the white vertebral stripe, which appears to be a variable character. The Mexican Badger is smaller than northern specimens of *T. americana*; but examples of the latter from southern localities—as those from Arizona—are scarcely larger than *T. berlandieri*; but in them there is no approach to the latter in coloration. The rather scanty material at hand, and the absence of correlated constant differences in the skull and teeth, are all that prevent the *T. berlandieri* of the Sonoran faunal area from being declared a distinct species from *T. americana*. Having no skins of *T. berlandieri* from the type locality (Northeastern Mexico), it is impossible to determine the exact relationship existing between the

Badgers of that region and those of Arizona, New Mexico, and Lower California. The result of a comparison of skulls from these regions is noted below.

*Cranial and Dental Characters.*—The series of 28 skulls examined furnishes 18 that are sufficiently grown to afford useful measurements, the remaining 10 being undergrown, several of them retaining, in part, the milk dentition. As skulls of different ages are unsuited for comparison, those of which the measurements are presented in the accompanying table, are arranged in the order of their respective ages, the specimens of the several subspecies falling in next to those that are nearest them in age, thus furnishing a more accurate means of comparison, in this small series, than if simple averages of the different subspecies were given. These 18 specimens are classified in four groups (as indicated by brackets in the accompanying table), as follows :

*a. Aged*, 8, with grinding teeth much worn, sutures obliterated, and occipital and sagittal crests strongly developed.

*b. Adult*, 3, with no traces of sutures below, and nasal sutures closed but not entirely obliterated.

*c. Nearly adult*, 3, with sutures closed, but nasal and basilar not obliterated.

*d. Youngish*, 4, with sutures closed, but the nasal, fronto-maxillary, and basilar, still distinctly traceable, and the teeth nearly unworn.

There is little in the skull or dentition of the American Badgers upon which to base specific distinctions ; and the differences in the several subspecies noted beyond, are merely average differences, subject to exceptions and variations. The size of the skull is the most variable character, the largest coming from Wyoming, and the smallest from California and Mexico. The skull of a young Badger from Wyoming (Nat. Mus., No. 3322, ♀, July 29, 1857), which had not finished shedding its milk teeth, is as large as those of nursing females from Arizona. I find nothing diagnostic in the dentition of the Badgers of any particular region, either in the size, shape, or processes of the teeth. There is a wide range of variation, which, however, appears to be individual rather than geographical. The measurements of the teeth do not show anything of importance; and aberrant specimens from any locality are as likely as not to find their closest analogues in those from the most distant part of the animal's habitat.

MEASUREMENTS OF SKULLS OF AMERICAN BADGERS, WITH RATIOS TO BASILAR LENGTH OF HENSEL.

| | Number. | Sex. | Locality. | Greatest length of skull (occipital condyle to front of premax'y). | Basilar length of Hensel. | Occipito-nasal length (occipital crest to front of nasals). | Inter-zygomatic breadth. | Inter-mastoid breadth. | Breadth across postorbital processes. | Least interorbital breadth. | Least postorbital breadth. | Alveolar rim of incisors to post-palatal notch. | Post-palatal notch to foramen magnum. | Height of cranium at plane of audital meatus. | Height of cranium from palate to point betw. postorb. processes. | Greatest breadth across molars (on alveoli). | Length of lateral series of teeth (on alveoli). | Greatest breadth across canines (on alveoli). | L'th pterygoid fossa (base of ham. proc. to deepest pt. postpal. notch). | Length of audital bullæ. | Width of audital bullæ. | Greatest length of mandible. | Height of coronoid process above angle. | Height of condyle from angle. | Length of lateral series of teeth of lower jaw. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | 2078 | | Quasquiton, Iowa | 129 | 115 | 110 | .... | 78.0 | 40.0 | 32.0 | 27.5 | 64.0 | 51.0 | 44.0 | 38.5 | 43.0 | 42.0 | 37 0 | 16.5 | 30.5 | 20.5 | 90.0 | 42.5 | 17.5 | 53.0 |
| | 11565 | | Wyoming Territory | 135 | 121 | 112 | 90.0 | 85.0 | 40.0 | 30.5 | 29.0 | 66.0 | 55.0 | 42.0 | 36.0 | 46.0 | 43.0 | 36.5 | 15.0 | 30.0 | 24.0 | | | | |
| | 2572/1874 | ♂ | Republican Fork, Platte River | 128 | 116 | 111 | 83.0 | 80.0 | 38.0 | 29.5 | 26.5 | 64.0 | 53.0 | 44.0 | 34.5 | 42.0 | 41.5 | 35.0 | 17.0 | 28.5 | 20.0 | 91.0 | 40.5 | 17.0 | 51.5 |
| | 21771 | | Kansas | 120 | 109 | 104 | 81.5 | 75.0 | 38.5 | 28.0 | 28.0 | 62.0 | 47.0 | 41.5 | 34.0 | 43.0 | 40.0 | 32.5 | 15.0 | 26.0 | 20.5 | 86.0 | 41.0 | 17.0 | 48.0 |
| | 1390 | | Matamoras, Mexico | 121 | 111 | 104 | 74.0 | 70.0 | 35.5 | 27.0 | 25.0 | 61.0 | 49.5 | 38.0 | 32.5 | 42.0 | 41.0 | 30.0 | 17.0 | 26.0 | 19.0 | 82.5 | 36.0 | 16.0 | 48.0 |
| | 4135 | | Cape St. Lucas, L. Cal. | 117 | 105 | 99 | 75.0 | 74.5 | 35.0 | 27.5 | 28.0 | 56.5 | 48.5 | 39.5 | 33.0 | 39.5 | 39.0 | 30.0 | 16.5 | 32.0 | 20.0 | 81.5 | 37.0 | 14.0 | 47.0 |
| | 1389 | | Matamoras, Mexico | 117 | 105 | ... | 73.0 | 70.0 | 34.0 | 27.0 | 28.0 | 57.0 | 47.5 | 40.0 | 32.5 | 42.0 | 40.5 | 32.0 | 15.7 | 27.0 | 20.0 | 81.0 | 38.0 | 17.0 | 48.0 |
| | 12908 | | Fort Randall, Dakota | 126 | 110 | 107 | 83.0 | 78.0 | 40.5 | 30.0 | 29.5 | 61.5 | 50.0 | 41.0 | 36.0 | 43.0 | 42.0 | 34.0 | 15.0 | 31.0 | 22.5 | 87.5 | 42.0 | 19.0 | 52.0 |
| b | 2456 | | Loup Fork, Platte River | 122 | 110 | 105 | 76.0 | .... | 33.0 | 27.7 | 28.0 | 61.0 | 49.0 | 40.0 | 32.3 | 41.5 | 42.5 | 32.0 | 15.5 | | | | | | |
| | 21777 | | ? | 122 | 110 | 105 | 83.5 | .... | 33.0 | 28.0 | 28.0 | 63.0 | 46.5 | 41.0 | 32.5 | 42.0 | 42.0 | 32.5 | 15.5 | .... | .... | 86.0 | 40.0 | 16.5 | 50.0 |
| | 2033 | | Upper Des Chutes, Oregon | 126 | 113 | 107 | 75.0 | ... | 35.0 | 29.0 | 29.0 | 63.0 | 50.0 | 39.0 | 31.0 | 40.0 | 41.0 | 32.0 | 15.0 | .... | .... | 88.0 | 40.0 | 16.5 | 50.5 |
| c | 2148 | | Valley of White River, Up. Missouri. | ... | 110 | 108 | 78.5 | 77.0 | 34.0 | 28.5 | 29.0 | 57.5 | 53.0 | 43.0 | 34.0 | 43.0 | 42.0 | 33.0 | 19.0 | 28.0 | 20.5 | 89.0 | 38.0 | 16.5 | 50.0 |
| | 15693 | | Bridger, Wyoming | 129 | 115 | ... | 78.0 | 78.0 | 36.5 | 30.0 | 30.0 | 67.0 | 49.0 | 44.0 | 35.5 | 43.0 | 41.5 | .... | 14.0 | 31.0 | 21.0 | 90.0 | 39.0 | 17.5 | 51.5 |
| | 6602 | | Near Snatch Creek, Dakato | 116 | 104 | 102 | 71.0 | 72.0 | 31.0 | 25.0 | 28.0 | 58.0 | 46.0 | 39.0 | 31.0 | 40.5 | 38.0 | 30.5 | 15.0 | 26.5 | 20.0 | 81.0 | 37.0 | 16.5 | 47.5 |
| d | 590 | ♀ | Pinal County, Arizona | 119 | 108 | 106 | 70.0 | 68.5 | 35.0 | 27.0 | 31.0 | 58.5 | 49.5 | 42.0 | 31.0 | 40.7 | 39.0 | 30.7 | 15.5 | 31.0 | 21.5 | 81.5 | 37.0 | 16.5 | 48.0 |
| | 1936 | ♂ | Near Fort Verde, Arizona | 116 | 105 | ... | .... | .... | 35.5 | 27.0 | 30.0 | 58.0 | 48.5 | .... | 33.0 | 40.5 | 39.0 | 30.0 | 14.0 | 27.0 | 21.0 | 82.0 | 37.0 | 16.5 | 47.0 |
| | 1935 | ♀ | Near Fort Verde, Arizona | ... | 104 | ... | .... | .... | 33.0 | 28.0 | .... | 59.0 | 45.0 | .... | 33.0 | 40.0 | 37.0 | 30.0 | 14.0 | 26.5 | 18.0 | 82.0 | 37.0 | 19.0 | 47.0 |
| | 4196/3832 | ♂ | Fort Crook, California | 118 | 106 | 101 | 75.0 | 71.0 | 31.0 | 26.0 | 27.5 | 59.5 | 46.0 | 40.0 | 32.0 | 42.0 | 39.0 | 32.5 | 13.0 | 29.0 | 20.5 | 82.0 | 40.5 | 19.0 | 47.5 |
| | Combined ratios of 10 spec. *T. americana* | | | 1.11 | 1.00 | .963 | .708 | .686 | .327 | .258 | .257 | .554 | .449 | .376 | .307 | .381 | .368 | .300 | .141 | .260 | .189 | .784 | .357 | .155 | .453 |
| | Two of *T. a. neglecta* (Nos. 2033, 4196) | | | 1.11 | 1.00 | .950 | .684 | .670 | .301 | .251 | .258 | .559 | .438 | .361 | .288 | .375 | .365 | .295 | .128 | .273 | .193 | .776 | .368 | .162 | .443 |
| | Types of *T. berlandieri* (Nos. 1390, 1389) | | | 1.10 | 1.00 | .937 | .681 | .649 | .322 | .250 | .246 | .547 | .449 | .361 | .301 | .389 | .377 | .287 | .151 | .245 | .180 | .757 | .343 | .153 | .445 |
| | Two of *T. a. berlandieri* (?) from Arizona | | | 1.10 | 1.00 | .... | .... | .... | .328 | .263 | .286 | .560 | .447 | .... | .316 | .386 | .363 | .287 | .134 | .256 | .187 | .785 | .354 | .170 | .450 |
| | *T. a. berlandieri* (?) from Cape St. Lucas | | | 1.11 | 1.00 | .943 | .714 | .709 | .333 | .262 | .267 | .538 | .462 | .376 | .314 | .376 | .371 | .286 | .157 | .305 | .190 | .776 | .352 | .133 | .448 |

The young individual of the Berlandier collection (No. 1391), figured by Baird, on plate xxxix of Mammals of North America, has newly acquired its second dentition. It is remarkable for the large size of the grinding teeth. The sectorial tooth of the upper jaw is sub-quadrate, with the inner cusps extraordinarily developed. A line drawn through these two cusps would be parallel with the cranial axis, whereas, in any other specimen of the genus that I have examined, it would form a rather obtuse angle. Furthermore, the upper true molar has three lines of tubercles that are approximately parallel to each other. As remarked by Professor Baird, the dentition of this specimen is quite different from that of the adult skulls from Matamoras upon which he based his account of *T. berlandieri*. These two skulls are before me. The differences between them and a series of skulls from the Mississippi and Missouri valleys are not great. The skull, in these types of *berlandieri*, averages considerably smaller, with the mastoids more inflated. The width of the skull, as compared with basilar length of Hensel, is less; but the length of the lateral series of teeth and the breadth across the molars, are relatively greater, this being correlated with its heavier dentition. The pterygoid fossa is longer. The skulls being mature, the molar teeth are considerably worn, but not so much as to entirely obscure the tuberculation, which never could have been as shown in Baird's figure of the young skull, in which the upper molar has three complete rows of tubercles which are nearly parallel to each other; but there is a tendency toward greater parallelism between the rows of tubercles than in northern skulls. No. 1935, from Fort Verde, affords the nearest approach, in this respect, to Baird's figure; there being, in fact, three rows of tubercles, but the posterior row is incomplete. As a rule, there are two rows of tubercles, with one or two additional irregular ones. The front row has three tubercles, of which the middle one is smallest, connected by a ridge which also joins them to the outer cusp of the tooth, forming a double curve; behind them is a second row of, usually, three tubercles that are in line with the inner cusp, and behind these are one or two additional ones, near the postero-lateral border. In the Missouri Badger the upper molar is relatively smaller, with the tubercles crowded and often irregular;

while in the Mexican animal, in which the surface is larger, they are usually disposed more nearly in parallel lines, as exemplified in the Fort Verde specimen, and of which the figured specimen in Baird's work furnishes an extreme instance. In the upper sectorial tooth, these old skulls do not show any marked departure from the usual form, such as the young one exhibits. The contiguous edges of the upper carnassial and molar teeth are in close apposition to each other by reason of their oblique insertion, their inner angles being rotated towards each other; but this does not afford a means of distinguishing them from Missouri skulls, as two of the latter exhibit this same peculiarity. Certain differences in the shape of the lower jaw were noted by Professor Baird, but these seem to have been individual rather than characteristic.

In Arizona skulls of *T. a. berlandieri* the shape and relative position of the teeth are about the same as in those from Matamoras, Mexico. The specimens at hand are not strictly comparable, however, those from Arizona having the teeth almost unworn, being considerably younger ; but the dentition seems to be lighter, in this respect resembling Arizona skulls of *T. americana.* A New Mexican skull of *berlandieri* (Nat. Mus., No. $\frac{22935}{4158}$), has the dentition in every way heavier than it is in Baird's types, though still quite young, with tubercles and cusps but little worn.

In an adult skull from Cape St. Lucas, collected by Mr. John Xantus (Nat Mus., No. 4135*), remarkable for the development of enormous mastoid and tympanic bullæ, the teeth are about as in typical *T. americana.*

The skull of No. 4196, from Fort Crook, California, is peculiar in having each of the three sides of the upper true molar strongly concave, or notched, so as to give it a trilobate shape. Another skull (Nat. Mus., No. 2033), from the Upper Des Chutes River, Oregon, referable to the same form, has lost the upper molars, so that it is impossible to say whether or not this is characteristic of this subspecies. Otherwise than as above, there is nothing pecu-

* This specimen (*i. e.* "No. 4135") has formerly been attributed to "Texas." See Dr. Allen's table, Bull. U. S. Geol. and Geogr. Survey, Vol. II, No. 4, p. 330. Its measurements are exactly as given by Allen ; and, though there may be a doubt as to the locality whence it came, it is doubtless referable to the southern type of Badgers.

liar in the dentition of these two skulls, which more closely resemble those of *T. americana* than *berlandieri.*

The milk dentition of our Badgers is correctly expressed in the following formula: d. i. $\frac{3-3}{3-3}$, d. c. $\frac{1-1}{1-1}$, d. m. $\frac{3-3}{3-3}=28$. The youngest skull at hand (No. 13,889, U. S. Nat. Mus.) has commenced shedding, all of the deciduous incisors having been displaced by their successors except the outer one on each side of the upper jaw, which still lies in front of the permanent tooth. An opening in the alveolar surface in front of the canine, and another small one behind the last deciduous molar, are the only indications of the permanent upper teeth of the lateral series. In the under jaw there is a good-sized opening, covered by periosteum, for the carnassial tooth. This skull measures only 80 mm. in basilar length by 61 mm. in inter-zygomatic breadth. In an older specimen (No. 25,529, U. S. Nat. Mus.), measuring 93 x 65 mm., the permanent premaxillary teeth are all present, the permanent canines are well above the alveolar rim in the upper jaw, and those of the under jaw are near displacing the deciduous canines. The foramen for the upper permanent molar is larger, the tooth appearing at the bottom of it, and the highest cusps of the sectorial premolar are just breaking through at the inner border of the alveolus, between the second and third deciduous molars. In the mandible the outer cusp of the sectorial tooth is even with the alveolus, and a small foramen marks the appearance of the last lower molar. A still older specimen (No. 3322, U. S. Nat. Mus., ♀, Bridger's Pass, July 29, 1857; W. S. Wood), measuring 106 x 72 mm., has shed all the deciduous teeth of the upper jaw except the middle molar, which is about to be displaced by the second (middle) premolar of the permanent set, which has risen into view between its anterior and internal roots. The permanent molar and sectorial teeth have grown well above their alveoli, and the canines of both jaws have nearly reached their full size. The anterior molar of the lower jaw has been shed on the left side, but is still holding fast by its posterior root on the right. A foramen for the middle premolar has appeared at the inner side of the second deciduous molar, between its two roots; but there are no signs of the appearance of the third premolar. The permanent molars are well grown. A nearly grown skull

from the Platte River (No. 3457, U. S. Nat. Mus., without sex or date) has shed all of the deciduous teeth above ; but the middle deciduous molar of the under jaw is still holding fast by a posterior fang, while the last deciduous molar is soon to be displaced by the third premolar, which has come into view, as usual, at the inner edge of the temporary tooth.

The dental formula of the adult is always : i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{1-1}{2-2}=\frac{16}{18}=34$. At no period, subsequent to birth, is there any indication of the presence of an additional premolar, as mentioned by Baird, and sometimes cited by other authors. It is not improbable that the appearance of the point of an emerging premolar in front of the first deciduous molar may have been mistaken for an additional tooth, as the anterior root of the deciduous tooth is usually absorbed, allowing of considerable separation of the crowns of the two teeth at the time of eruption.

As usual, the milk molars epitomize the more complicated series of grinding teeth of the adult animal. The crown of the anterior upper molar forms a simple blade or cusp, without heel, though concave in its posterior profile ; it lies to the inner side of the general line of the lateral series of teeth, and is placed obliquely, with its posterior root internal. The second molar is 3-rooted and resembles the carnassial tooth, but is less expanded internally, and lacks the posterior tubercle on that side. The third tooth is molariform, of triangular shape, with the apex internal, its crown roughened by prominent tubercles. In the under jaw the first and second deciduous molars resemble premolars, and the third represents the carnassial tooth of the second dentition.

In the preceding pages, the comparative characters of the two recognized American Badgers (*T. americana* and *T. a. berlandieri*) have been given with as much fullness as the limited material would permit, and it remains to characterize a third and very distinct subspecies, as follows:

## **Taxidea americana neglecta,** subsp. nov.

Type, No. $\frac{4196}{3835}$, U. S. Nat. Mus. Coll., ♂, Fort Crook, Northern California; collected by John Feilner (orig. No. 313).

*Description.*—Smaller than *Taxidea americana*, with longer tail; pattern of coloration similar, but the colors much deeper and richer, in this respect contrasting more strongly with the common Badger than does the Mexican Badger; dark markings of head more brownish; light areas yellowish instead of whitish; feet and lower part of legs dark brown instead of glossy black; hairs of upper surface, ochraceous buff, banded subbasally with grayish drab, subapically with black, and broadly tipped with yellowish gray; tail, tawny ochraceous, the hairs pointed with grayish above, except at the tip, which is dark brown; end of chin, light brown; under side of head and neck, yellowish clay-color; chest and sides of abdomen, tawny ochraceous, creamy white in the middle of the abdomen; claws, horn-color.

The skull appears to be much smaller than that of *T. americana*. As far as can be judged from the two specimens before me it is relatively narrower and lower, more constricted in the interorbital region, with the bony palate slightly longer, and the audital bullæ considerably larger. The brain-case is smaller, and the height of the lower jaw, at coronoid and condyloid processes, greater. The dentition is lighter, and the upper molar constricted on each of its three sides, giving the crown of this tooth a 3-lobed appearance.

ARTICLE XIX.—*Notes on the Otter (Lutra canadensis) and Skunks (Genera Spilogale and Mephitis) of Arizona.* By EDGAR A. MEARNS, Assistant Surgeon, U. S. A.

The Otters of North America, north of Mexico, vary considerably in size and in certain minor points in the skull and dentition, but their uniform color pattern admits of only a slight variation in the shade of color. The value of certain differences observed in the shape and size of the nasal pad, and the amount of hairiness of the palms and soles, is yet undetermined, from lack of sufficient material.

Through the kindness of Mr. F. W. True and Dr. J. A. Allen, I have been afforded the opportunity of comparing the skulls of three Otters obtained by me in Arizona with those of this genus (*Lutra*) in the United States National Museum and the American Museum. Besides Mexican and other foreign material, this gave for comparison 34 skulls from North America, of which 3 are from unknown localities, 15 from east of the Mississippi River, and 16 from west of it, the localities represented being as follows: Labrador (2); Lake Superior (2); New York (2); Wisconsin (1); Illinois (1); Indiana (1); Washington, D. C. (2); South Carolina (2); Georgia (2); Fort Kearney, Nebraska (1); Fort Resolution, H. B. T. (1); Indian Territory (1); Alaska (8); Oregon (2); Arizona (3).

With respect to the size of the skull, the widest extremes are represented by an aged specimen (Nat. Mus., No. 2247) from Saranac Lake, New York, and one from Alaska (Nat. Mus., No. 8687). In the former the canines are worn nearly down to the alveoli, and the grinding teeth are much worn, but the sagittal and occipital crests are but slightly developed, the whole skull being light and thin. In the latter the bony ridges, the zygomatic arch, the mandible, in short the whole skull is massive, weighing more than thrice as much as the New York specimen; but the teeth are perfect in this specimen, there being no indication of senility. These two skulls measure, respectively, 102 x 66 and 122 x 84 mm. These wide extremes are quite fully connected by intermediate sizes. Though the size variation is perhaps chiefly geographical, it is also largely individual. The series from single

localities are too small to show the amount of purely individual variation, which, however, is great, as shown by a comparison of the eight Alaskan skulls, in which an apparently aged skull (Nat. Mus., No. 21,480) having the grinding teeth worn, and the lower canines reduced to the level of the incisors, measures only 105 x 73 mm., falling short of the dimensions of the largest Alaskan specimen, above referred to, 17 mm. in length, and 11 mm. in width. This skull is exceeded by several of the largest eastern skulls, which latter, however, fall short of the average of Alaskan and western skulls generally. The measurements of six skulls from Umbagog Lake, Maine, given by Dr. J. A. Allen, in his valuable paper on the geographical variation in North American mammals,* range from 101–114 mm. in basi-cranial length by 69–76 mm. in inter-zygomatic breadth (average 109 x 74 mm.). This may be regarded as an approximate average individual variation. How much of this difference in size is due to difference of sex it is impossible to determine, since few of the above specimens are marked with the sex. In the Arizona skulls the males are larger than the single female, but the difference is slight, the female being older than either of the males. As Dr. Allen has shown, latitude exerts but little influence in the size of the eastern Otter, "skulls from Newfoundland, Maine, Lake Superior, Washington, and Georgia agreeing very closely in dimensions." The western Otter is larger than the eastern, as shown by specimens from Alaska, Oregon, and Arizona. The case is closely parallel to that of the Mink, in which a small nominal species is found in New York and northward, the species increasing in size to the westward, the largest specimens being found in Alaska ; but the latitudinal variation in the size of the Mink is greater than in the Otter.

Before a good series of skins as well as skulls of our Otters has been accumulated, attempts to separate geographical races will be premature, though it is not improbable that one or more may be advantageously recognized in the ultimate refinement of mammalogical science; but, as we already have several worthless nominal species of Otters, I will not assume the risk of adding to the confusion by naming any new subspecies.

* Bull. U. S. Geol. and Geog. Surv. Terr., Vol. II, No. 4, 1876, p. 331.

The Arizona Otter bears a close resemblance to the specimen described by Baird as *L. californica*, from the Cascade Mountains, Oregon (of which there is an additional skull in the National Museum series, taken at Fort Klamath, Oregon, by Dr. J. C. Merrill, of the army), than to any others in the present series. The size and proportions of the animals are similar, and the skull (more especially the Fort Klamath specimen) shares several peculiarities with the Arizona skulls. The shape of the nasal pad appears to be the same, though that of even the smallest Arizona specimen (Am. Mus., No. 309) is somewhat larger, measuring 24 mm. in width by 19 mm. in height. From the Alaskan series of skulls (I have seen no skins) they differ in being somewhat smaller, less massive, broader, with more evenly-rounded zygomatic arches, and with the brain-case more convex or bulging in its outlines. Arizona skulls differ from all others in the slender, attenuated postorbital processes, and in the greater height of the under jaw, in its measurements from angle to condyle or to summit of coronoid process. From its geographically near neighbor, *L. felina*, of Central America, it presents many cranial and dental differences; in fact, skulls of the latter are so very distinct from those of any known specimens from North America, north of Mexico, as to be distinguishable from them at a glance. Dr. Coues was disposed to unite with this Mexican Otter the Alaskan specimens of *L. canadensis*. He observes that "the skulls of the Alaskan Otter, unfortunately, are unaccompanied by skins; but they lead me to suspect that they may be those of an animal the same as the Mexican species. This would accord with the ascribed range of the species (from Chili to Kamptschatka); but the point cannot be determined until skins are examined from this region, as the skulls alone do not furnish grounds for separation." With this last statement I cannot agree. The skulls alone proclaim them to be two wholly distinct species. The skull of *Lutra felina*, as compared with North American Otters, differs in being concave inferiorly, with the upper outline much depressed anteriorly, the muzzle much shortened, the nasal orifice much smaller and the opening more oblique, the postorbital processes more broadly triangular, the postorbital constriction much greater, the hinder portion of 'palate' nar-

rower, the brain-case broader, the zygomatic breadth greater, and the mandible and lateral dental series shortened in correspondence with the reduced muzzle. Diagnostic points in the dentition are the absence of the heel in front of the antero-internal cusp of the last upper molar, the shortness of the lateral series of teeth, and the less width across the upper incisors and greater width across the upper canines, resulting in a wider interval between the incisor and canine teeth. The above observations are based on specimens in the United States National Museum, one of which bears the initials of Dr. Coues.

An Otter skull from Raleigh, North Carolina (Am. Mus., No. 890), resembles other skulls of *L. canadensis*, except that it has an additional posterior molar in the upper jaw, which gives it the following dental formula: i. $\frac{3-3}{3-3}$, c. $\frac{1-1}{1-1}$, pm. $\frac{4-4}{3-3}$, m. $\frac{2-2}{2-2}=\frac{20}{18}=38$. This adventitious molar seems to be analogous to the last under molar. It measures 2.6 mm. across the crown, on the right side, the corresponding tooth on the opposite side having been lost, but, from the size of the alveolar socket, it appears to have been somewhat larger. With the above notable exception, I have found no peculiarities in the dentition of North American specimens which could not be matched by others from opposite geographic regions.

The following description of a specimen of the Arizona Otter was written with the freshly-killed specimen in hand:

*Description* (No. $\frac{3712}{309}$ (Am. Mus. Catal.), ♀ ad., Montezuma Well, Beaver Creek, Yavapai County, Arizona, December 26, 1886).—In form this animal resembles both the Seal and the Beaver. The neck and head are very suggestive of those of the Seal, while the limbs and rest of the body are not unlike those of the Beaver. The tail is flattened and cartilaginous as in the Beaver, but is coated densely with hair like other members of the family Mustelidæ. It is wedge-shaped, broad at base, flattened above and below, tapering to the point. There are patches of bristles behind the eyes, angles of mouth, and on either side of both muzzle and chin. The nasal pad is black, and considerably broader than high, being undivided by a hairy septum. The furry coat of the Otter resembles the Beaver's, having a dense coat of short fur and copious outer covering of longer stiff hairs having a fine gloss. There are no distinct markings. Color above dark brown, without reddish tinge; this color changing gradually to a light grayish brown below, being palest—almost whitish—upon the sides of the head below the level of the eyes, and upon the under side of the head and neck as far back as the fore limbs. In point of col-

oration, the extremities, including tail, exhibit no strong contrast with corresponding surfaces of the trunk, but are rather darker. The long hairs of the lighter portions of the body are pointed with yellowish gray; and upon the upper surface of the head and neck the tips of the hairs are yellowish brown, giving a paler cast to that part of the dorsum. There are some hoary areas to the upper surface in which there are some scattered white hairs intermixed with the brown. This is said by trappers to be an indication of advanced age, which its well-worn teeth further attest. The under coat is crimped, silky, and exceedingly dense; at base white, shading to grayish towards the apex. The fur is much worn upon the lower part of the neck and sides of the tail, probably from attrition with grass and driftage when swimming about. The palms and soles are hairy between the pads, much as in the northern Otter. Weight, $19\frac{7}{16}$ pounds, Avoirdupois.

*Dimensions.*—Measurements of No. $\frac{3712}{309}$, ♀ ad. (Am. Mus. Catal.): total length, 1300; head and body (measured from tip of nose to anus), 815; tail, measured from anus to end of vertebræ, 472, to end of hairs, 487, width at base, 115, depth at base, 55; ears, height above crown, 15, above notch, 23, width, 24; longest whiskers, 60; girth of head (measured between eyes and ears), 260; girth at middle of neck, 280, at chest, 365, at abdomen, 450, at loin, 383, at base of tail, 178; from tip of nose to front teeth, 20, to angle of mouth, 53, to eye, 44, to centre of pupil, 49, to ear, 95, to external auditory meatus, 100, to tip of ear, 125, to occiput, 155; distance between eyes, 43; fore limb from coracoid process of scapula to end of longest claw, 210, from olecranon, 170; manus, length, 87, width, 44, greatest expanse, 93, claws, 10.3, 10.5, 10, 10.2, 10.5; hind limb from head of femur to end of longest claw, 300, from knee-joint, 250; pes, length, 146, width, 52, greatest expanse, 115, claws, 10, 9.5, 11, 10.5, 13; greatest expanse of fore limbs, outstretched, 500, of hind limbs, 575. Measurements of No. 1932 (Am. Mus. Catal., entire skeleton), ♂ ad., Verde River, Arizona, January 23, 1887: total length (after skinning), 1275; fore limb from coracoid to end of longest claw, 222, from olecranon, 83; manus, 94, claws, 13.6, 14, 13.4, 13, 12.5; hind limb from head of femur to end of longest claw, 310, from knee-joint, 238; pes, 145, claws, 13, 14.5, 14.5, 13.6, 14.2.

## **Spilogale phenax arizonæ,** subsp. nov.

(Arizona Striped Skunk.)

Thirteen specimens of the species recently described by Dr. C. Hart Merriam as *Spilogale phenax*,* taken by the author in the vicinity of Fort Verde, Arizona, prove to be subspecifically separable from the typical form, from California, of which I have six skins and skulls before me for comparison. The Arizona Striped Skunk may be known by the following diagnosis:

* North American Fauna, No. 4, October 8, 1890, p. 13.

Type, No. $\frac{2480}{1901}$, ♂ ad., American Museum collection. From near Fort Verde, Central Arizona, March 13, 1886. Collected by Edgar A. Mearns. (Original number, 336.)

*General Characters.*—Smaller than *Spilogale phenax*, with tail relatively as well as actually considerably longer, with hairs about equaling the length of head and body; feet larger; fur much finer and softer; pattern of marking similar; usually without the white markings on chin, but retaining those at angle of mouth; white stripes averaging a trifle narrower, and snowy instead of creamy white; rump spots smaller, and those on the side of tail at base only confluent above in one specimen, whereas such is the rule in California specimens; black areas faded to brownish or grayish black—much as in *S. gracilis*—instead of glossy black, especially below.

*Cranial Characters.*—Skull smaller, and relatively broader than in *S. phenax*, with more spreading and higher zygomatic arches; postorbital constriction marked; postorbital processes but slightly developed. The largest skull, a male, measures 38 mm. in zygomatic breadth by 56 mm. in basi-cranial length.

*Measurements of Type* (from fresh specimen).—Total length, 445; head and body, 305; tail to end of vertebræ, 160, to end of hairs, 260, width outspread, 250; girth of chest, 140; ear above crown, 16, above notch, 28, width, 20; longest whiskers, 50; distance between eyes, 20; diameter of eye, 7; from tip of nose to incisor teeth, 11, to eye, 26, to centre of pupil, 31, to ear, 50, to external auditory meatus, 51, to tip of ear, 72, to occiput, 72, to end of outstretched hind limb, 375; fore limb from head of humerus to end of longest claw, 108, from olecranon, 78; length of manus (measured from behind pisiform bone), 40, width, 19, claws of manus, 8, 12, 10, 9, 8; hind limb from head of femur to end of longest claw, 127, from knee-joint, 87; length of pes, 50, width, 16, claws of pes, 6, 6, 6, 6.5, 6 mm.

*General Remarks.*—The sexual difference in size is great in this species, as indicated by the skulls, as well as by the measurements of eight fresh specimens. Four of eleven skulls are those of females, two of them being rather young adults, the remaining two quite young though with sutures closed; but the largest of them is considerably smaller than the two youngest and smallest of the seven males, in which the sutures remain open. The skull of No. 1905, of the American Museum collection, taken at Fort Verde, Arizona, October 26, 1885, a young but apparently nearly grown male, is the only one of the twenty-seven skulls of this genus examined in this connection in which the first premolar is wholly lacking on both sides of the upper jaw, leaving but three teeth behind the canine. The remaining teeth, including those of the mandible, are normal. In several other speci-

mens of the present subspecies, as well as in a specimen of *S. lucasana*, this tooth has disappeared on one side of the jaw, but always in oldish individuals, leaving a distinct diastema marking its former position. The tail varies considerably in length. That of the type specimen is unusually short. In two of the seven specimens measured in the flesh it exceeds the length of the head and body, equaling or falling more or less short of that in the remaining five. The tail averages 94.2 per cent. of the length of the head and body, the vertebræ alone 54.5 per cent.

All of the Skunks of this genus in the vicinity of Fort Verde are the present subspecies; while all of those taken by Mr. W. E. D. Scott, in Pinal County, Arizona, at a higher altitude, in the oak-timbered zone, were *S. gracilis*.

A skull in the American Museum collection (No. 1900), unaccompanied by the skin, taken at Flagstaff, Arizona (in the *Pinus ponderosa* belt), indicates a species perhaps different from the present or *S. gracilis*. If either of these, it must be the latter, with which it agrees in the long pterygoid fossa, narrower skull with less spreading zygomatic arches, and less measurement across upper molars and of lateral tooth-row than in *S. phenax*. It has the pterygoid fossa much longer than the combined length of crowns of upper molar and sectorial tooth, insomuch that it agrees with *S. saxatilis;* while, in the enormous and evenly rounded mastoid bullæ, with but slight trace of lateral ridges, it resembles *S. leucoparia*.

## A Study of the Arizona Skunks of the Genus *Mephitis*.

Dr. C. Hart Merriam has recently ventured to name a new species of this difficult genus, on the strength of one adult and two young individuals, taken by himself, at the base of San Francisco Mountain, Arizona.* He has pointed out characters serving to distinguish it very readily from *Mephitis mephitica* or *M. occidentalis*, but makes no comparison with the Texan and Mexican species, with which a much closer relationship exists, dismissing the subject by remarking that "*M. estor* may be distinguished at a glance from *M. macroura* by the shortness of its tail." That the type of *M. estor*, an old male, had an abnormally

* North American Fauna, No. 3, p. 81, September 11, 1890.

short tail, is evident from the fact that the tail measurement of the two young and much smaller female specimens obtained by Dr. Merriam equals or considerably exceeds that of the adult male. The skull of the type specimen also presents certain peculiarities that are unusual, as the narrowness across the mastoids, and great distance from the foramen magnum to the postpalatal notch, which are only paralleled by one other skull from Arizona (No. 600, Am. Mus. Coll.). This difference aside, the skull of *M. estor* presents no noticeable departure from average skulls of this genus from other portions of Arizona, except that it is slightly larger than the average. On the whole, the thirty Arizona skulls of *Mephitis* before me show little even of individual differences, the sexes, apparently, being more nearly of a size than in the northern species. The figured skull of Dr. Merriam's type of *Mephitis estor* shows the dentition of that species to be in strict agreement with that of the series of sixteen specimens from Fort Verde, Arizona, collected by the writer, and thirteen from Pinal County, Arizona, collected by Mr. W. E. D. Scott, except that the lateral rows of teeth are less divergent posteriorly, owing to the narrowness of the skull of the type specimen; but No. 600, Am. Mus. Coll., from Pinal County, has the same conformation, and, as a coincidence, as short a tail as that of the type of *M. estor*.* The average basi-cranial length of twelve of the oldest specimens from Arizona (six males and six females) is 64.6 mm. (extremes 60 and 68 mm.), this being about 4 mm. less than the type of *M. estor*.

As to the length of tail, the series of measurements taken by me from fresh specimens, at Fort Verde, Arizona, shows this to be an extremely variable member, the vertebræ alone, in adult specimens, ranging from 272 to 335 mm., the shortest tail (No. $\frac{2471}{1887}$, Am. Mus. Coll.) falling considerably below the maximum of *M. estor*, while the longest (No. $\frac{2473}{1913}$, Am. Mus. Coll.) exceeds Lichtenstein's measurement of his *M. macroura*. In the longest-tailed

* The ratio of the two measurements, from foramen magnum to hinder margin of palate, and breadth across mastoids, is by no means diagnostic of *M. estor*, as skulls from Essex County, New York (Nat. Mus. No. 3816), Santa Clara, California (Nat. Mus. No. 2031), Fort Randall, South Dakota (Nat. Mus. No. 12,911), and Kansas (Nat. Mus. No. 6557), all have the former measurement the greater, while No. 1394 (Nat. Mus. Coll.), from Matamoras, Mexico, has the two measurements equal. Therefore, the greater distance from the foramen magnum to the postpalatal notch than that across the mastoids in the type of *M. estor*, cannot be taken as a specific character.

specimen from Fort Verde, the vertebræ of the tail, measured from *os sacrum*, equal the length of the head and body. The ratio of the length of the caudal vertebræ to that of head and body, in several forms of *Mephitis*, is as follows: in nine specimens from Fort Verde, Arizona, 87.9 per cent.; in Dr. Merriam's three specimens of *M. estor*, approximately,* 84.9 per cent.; in Lichtenstein's *M. macroura*, 92.7 per cent.; in Baird's Texan specimens, referred by him to *M. varians*, 98.5 per cent. It thus appears that the *Mephitis* of Arizona has a tail *averaging* less than that of the Skunks of Texas and the adjacent portions of Mexico, which, taken with its smaller size, slightly weaker dentition, and lighter ossification may serve to separate it from them, though it may be difficult to dispose of individual specimens, from intermediate localities.

For the present I would refer all Arizona specimens to *M. estor*, a form distinguishable from *M. macroura* or *M. varians* by its somewhat smaller size, shorter tail, and weaker dentition, especially as to the upper true molar. In view of the extreme variation in color exhibited by Arizona specimens, the pattern of the white markings cannot be allowed much prominence in the definition of the species. That described by Dr. Merriam is as common as any. In all there is a white frontal stripe, though in No. 1346, of the American Museum collection, this is reduced to a mere trace; and the terminal pencil of differentiated white hairs also appears to be constant, even in specimens with black tails. As to the white dorsal markings, the various forms of pattern described by most authors are all more or less applicable here, from those in which the whole back and upper surface of tail are white, as in *Conepatus*, to the example above mentioned (Am. Mus. No. 1346), in which, in addition to the trace of a frontal stripe, there is only a very narrow white stripe from shoulder to thigh, low down on the sides. In this specimen the tail is black, with the hairs white at base, and the usual terminal tuft of peculiar white hairs. The most marked peculiarity that I have noted in this species is the enormous development of its ears, which at first led to the suspicion that the Fort Verde specimens might prove to be a distinct form, peculiar to the Sonoran faunal

* Assuming that the head and body equal the total length minus the tail.

region. These specimens are distinguished from those of higher regions in Arizona by the scantiness of the coat, the less hairy soles, and longer claws, all of which are readily accounted for by the difference in climate and soil, those living in rocky places, in the mountains, usually having shorter claws than those from the soft soil of the valleys. The greater length of the claws gives an increase in the measurements of the manus and pes over those collected by Mr. Scott and Dr. Merriam, from more elevated localities. Dr. Merriam describes *M. estor* as having "small" ears, measuring but 8 mm. in height above the crown, in skins, whereas the measurements of adults taken by myself at Fort Verde, from fresh specimens, average just twice that. Mr. Scott's specimens measure about 11 mm., in dry skins, thus appearing to be intermediate in this respect. The large Skunk of the Upper Mississippi region has ears that measure about 12 mm., in fresh specimens.

The Texan and Mexican skulls, of which there are six adults,* present two quite different sets of sizes (extremes 65 and 74 mm. in basi-cranial length), three of each. This difference of size is probably sexual, both coming from one locality, as those from Matamoras, Mexico. The six skulls agree among themselves, and differ from Arizona skulls, in having the posterior upper molar very large, as shown in Baird's figure of *M. varians* (Pl. lx, fig. 2), the dentition as a whole being rather stronger than in the Arizona Skunk. After taking a careful series of measurements of these six skulls from Texas and Mexico, and of twice that number (sexes equally represented), selected from the Arizona series of thirty, and reducing the average of the various dimensions to percentages of the basilar length of Hensel, we are prepared to make a somewhat satisfactory comparison of the two forms. In *M. estor*, the zygomatic arches are more expanded, while the breadth across the mastoids is decreased. The breadth across the postorbital processes is greater, the interorbital region being relatively more constricted. The cranium is higher posteriorly, the pterygoid fossa longer, and the mandible considerably higher at the coronoid and condyloid processes. The length of

* Kindly loaned me, with many others of the genus *Mephitis*, by the authorities of the U. S. National Museum, at Washington, to whom I take pleasure in acknowledging this further obligation.

the lower molar series is less, the measurement from last molar to extremity of condyle being proportionately greater. The ratios of the other measurements taken are almost identical with those of Mexican or Texas skulls.

ARTICLE XX.—*Notes on New or Little-known North American Mammals, based on recent additions to the Collection of Mammals in the American Museum of Natural History.* By J. A. ALLEN.

During the last four years about 3000 skins of small mammals, in most cases accompanied by their skulls, have been added to the collection of the American Museum of Natural History. These specimens represent new material, in most cases collected expressly for this Museum. Several of the more important collections received have been made the subject of special papers, already published in this Bulletin. Much of the remaining material has, however, not been critically examined until within the last few months; the more important results of this examination are embodied in the present paper.

The last five years have been eventful in the history of North American mammalogy, following as they do a considerable period of comparative inactivity in this important field. In 1857 was published the great work of the late Prof. S. F. Baird on North American Mammals, forming Volume VIII of the "Reports of Explorations and Surveys to ascertain the most practicable and economical Route for a Railroad from the Mississippi River to the Pacific Ocean," based on the material then extant in the Museum of the Smithsonian Institution, and consisting mainly of specimens collected by the various Government expeditions during the preceding four or five years. The material available for this great work consisted of less than 3000 specimens, a large proportion of which were of very poor quality when compared with the material gathered within the last few years. During the following fifteen years the mammalogical material in the Smithsonian Institution steadily increased, the number of specimens being about threefold greater at the end of this period (1872) than in 1857. Yet very little use had been made of it as the basis of publication, the status of the subject remaining essentially as left by Professor Baird in 1857. No other collection of any magnitude had been formed in the meantime, except that of the Museum of Comparative Zoölogy at Cambridge, which was more local in character and far less important than the one in Wash-

ington. A little revisionary work had, however, been attempted on the basis of the Cambridge collection, as also certain special investigations relating to the subject of individual variation, for which the Cambridge material was especially favorable, since it included large series of specimens of the same species from single localities. While the results of these investigations were highly instructive, and sound in the abstract, they unfortunately led to erroneous conclusions, which only a vast accumulation of well-prepared material could successfully controvert. It was shown that the normal range of individual variation was much greater than had been previously suspected; consequently it was naturally assumed that general size, the size and relative proportion of special parts, including even the number of caudal vertebræ, were unsafe characters for the basis of species, especially when resting on a single specimen, or even on a small number of specimens. In other words, it was found that the range of purely individual variation often overlapped the differences considered in many cases to be specific. In respect to coloration there was found also a wide range of variation in individuals of the same species from the same locality, a large part of which was obviously due to season, and much also to age. It was also found in many instances that specimens from intermediate points between the habitats of supposed distinct species presented intermediate characters, and that the two alleged species evidently intergraded and were thus to be properly recognized as only geographical forms of a single widely distributed species.

These discoveries had much influence on the subsequent revision of various groups of North American mammals, made by various investigators during the following decade, when, in 1874 to 1880, the accumulated materials of the preceding twenty years were again subjected to critical examination. As a result, the status of the components of entire groups was radically changed; not a few species being relegated to synonymy, and many others (in most cases justly) reduced to the rank of subspecies. But still the specimens serving as the basis for this new departure were of a most unsatisfactory character, as regards not only their preparation, but the data accompanying them, when compared with the material of to-day. Distorted, flat, or only partly-filled

skins, with the skulls left in them; the locality and date of collecting often wholly omitted or only vaguely indicated, and the only available measurements such as could be obtained from the distorted skins,—such was the character of the material then available, contrasting with the carefully made skins, with the skulls separate, accompanied by full field data and measurements taken by the collector from the fresh specimen, forming the basis of our present work. There was thus little opportunity for the recognition of nice points of difference, or for the study of seasonal variation in color, there being rarely any considerable series of specimens from any one locality, and still more rarely series representing opposite periods of the year. With the finer distinctions masked by the bad quality of the specimens, and no clue to seasonal variations in pelage, and with the wide range of normal individual variation strongly in mind, it was not difficult to apparently "match" specimens from widely distant points, and on the strength of this to jump at conclusions which seemed reasonable, and which were apparently warranted by the material then in hand, but which the substitution of large series of properly prepared specimens from single points in place of isolated imperfect examples now show to have been erroneous.

During the last few years more specimens of the smaller species of North American mammals have been collected *annually* than Professor Baird had at his disposition for the basis of his great work published in 1857. Hence the accumulation of material in recent years, when the amount and quality are both considered, affords a basis for work never before available, and its elaboration is yielding results little less than startling to even the best informed among our mammalogists. It is not, then, surprising that those unfamiliar with the resources of to-day look with some disfavor upon what seems to them the "splitting craze" of the day; yet when confronted with the actual specimens in almost any given case they are forced to admit that the previously discredited "split" seems tenable. While it is true that during the last two years many closely-related forms have been recognized in nomenclature, a large number have been described that have no close relationship to anything previously known, which at least goes to show that our knowledge of the mammalian fauna of North

America is still very imperfect. The standard of division is in reality scarcely different from the guage by which Baird measured in 1854 to 1857. It is simply that our material is more ample; that new localities have been explored, and thorough systematic field work has taken the place of the wholly fortuitous, sporadic collecting of earlier days. In fact, some of the long-discredited species recognized by Baird in 1857 are found to have an actual basis in nature, a case in point being his *Neotoma micropus*, considered at length later in the present paper. While many of his species have long since been reduced to the rank of subspecies, very few of them are found to rest on a pure misapprehension of characters. Considering his resources, his acuteness and sagacity stand out only the more prominently as time goes on and our knowledge of our mammals advances.

It is hence a serious matter to know how to treat many of the earlier species of Baird and others in cases where the types have been destroyed or where they have become so faded by exposure to light, or deteriorated by long immersion in spirits as to be worthless for purposes of comparison. In some instances the original description is so explicit that, coupled with the locality, there is little difficulty in identifying the form a given name was apparently intended to designate, at least in the case of Baird's species, or those of earlier authors as defined by him in his "Mammals of North America;" cases in point being *Hesperomys texanus*, *H. nebracensis*, *Neotoma micropus*, etc. Where types exist, however, they serve to show, as in the case of *Perognathus hispidus*, and in the *Dipodomys* and *Dipodops* groups, the uncertainty of depending upon descriptions alone, in any group of closely-allied forms. Yet, in cases where the type is not extant, it seems better to fix the name to some form from the vicinity of the original locality which agrees reasonably well with the diagnosis than to discard the name as wholly undeterminable, and accept the status of the form as determined by the revisor who first fixes the name to a known recognizable form, in the same way as, or in accordance with the principle by which an old genus is subdivided and the name retained for a certain portion of the old composite genus, where the authority of the revisor is recognized as fixing the type and status of the original generic name.

The present must be recognized as a renaissance period in the history of North American mammalogy. While our material is so greatly in excess of that of earlier days it is yet meagre in comparison with what is necessary for final work. While it serves to show how rich the field still is, it is as yet tantalizingly deficient. Our work for the present must be in large part tentative. Yet it is necessary to progress that some use be made of it. Should the present methods of field work be continued for the next ten years, the combined material of all the collections then extant would be none too ample for the intelligent treatment of problems that now confront us on every hand. Where we have now a hundred specimens of a given group, thousands more are absolutely necessary to reach conclusions that can be considered as in any way final. In few instances can we satisfactorily trace the relationships between the various members of a group of closely-allied forms, or decide whether certain forms intergrade or have become fully differentiated; whether certain differences are in part seasonal, or merely individual, or are characteristic of the individuals of a more or less limited area, the boundaries of which we can at present only surmise. While a merely cursory examination of a large series of specimens of a group of closely-allied forms is sufficient to show the influence of environment, the character and mode of its action are to a large extent still problems for investigation.

The groups more especially considered in the present paper are the genera *Heteromys*, *Dipodomys*, and *Dipodops* of the family Saccomyidæ, and various forms of the genera *Neotoma*, *Vesperimus*, and *Oryzomys*. Other little-known species of other families are briefly noticed in cases where recent accessions of material throw light upon their status, relationships, or distribution.

I wish here to acknowledge my indebtedness to Mr. F. W. True, Curator of Mammals in the U. S. National Museum; to Mr. Wm. Brewster, Curator of Mammals and Birds in the Cambridge Museum of Comparative Zoölogy, and to Dr. C. Hart Merriam, Chief of Division of Ornithology and Mammalogy, U. S. Department of Agriculture, for the loan of much valuable material, without the aid of which the preparation of this paper would have been impossible.

## **Heteromys alleni** *Coues.*

*? Heteromys albolimbatus* GRAY, P. Z. S., 1868, p. 205.
*? ? Heteromys irroratus* GRAY, *ibid.*, p. 205.
*Heteromys longicaudatus ?* ALLEN, Bull. Mus. Comp. Zoöl., VIII, No. 9, 1881, p. 187.
*Heteromys alleni* COUES, *ibid.* (ined. MS.).

Ten years ago, in a paper on a collection of mammals made in the State of San Luis Potosi, Mexico, by Dr. Edward Palmer, I recorded (l. c.) a single specimen of *Heteromys* from Hacienda Angostura, Rio Verde, this being the most northern point from which the genus was then known, its previous most northern record being the State of Oaxaca. The specimen was provisionally referred to *H. longicaudatus* Gray, with the following statement: "The present example differs apparently in important features from either of these [*H. desmarestianus* and *H. longicaudatus*], and a detailed description of it is therefore appended." This description was by Dr. Coues, to whom the specimen had been referred some time previously, and who returned it under the MS. name *Heteromys alleni*, with the long description published as above cited. In view, however, of Mr. Alston's conservative treatment of the group, then just published, it seemed to me preferable not to take the chance of adding another nominal species to the number already assumed to exist. Material recently received, however, shows that Dr. Coues was probably justified in his opinion that the San Luis Potosi specimen represented a species not previously recognizably described.

The material before me relating to the genus *Heteromys* consists of four dry skins, two additional skins in alcohol, and three specimens in spirits, all from Costa Rica (see antea, p. 215), and representing *H. longicaudatus ;* and also four specimens (skins, two with the skulls separate) representing *H. alleni.* These include the original type of the latter from San Luis Potosi (No. 5889, Mus. Comp. Zoöl.), a specimen from Moro Leon, Guanajuato, Mexico (No. 15,529, U. S. Nat. Mus.), and two from Brownsville, Texas (Nos. 3786 and 3787, Am. Mus. Nat. Hist.), taken Jan. 18 and 28, 1891. The Brownsville specimens most unexpectedly demonstrate the extension of the habitat of the genus northward to the mouth of the Rio Grande in Texas.

*H. alleni* differs very markedly in coloration from *H. longicaudatus*, and also in having the tail heavily haired and conspicuously penicillate. It may be distinguished at sight from the other recognized species not only by this last character, but by its conspicuously white-edged ears and the broad stripe of fawn color which separates the dark color of the dorsal surface from the pure white of the ventral surface. The very full description given by Dr. Coues (l. c.) leaves nothing further to add. The Brownsville specimens agree closely with the type, except that the tail is less heavily clothed, but this difference is obviously accidental, the hair being worn off and in one of the specimens more or less patchy in its distribution.

The collector's measurements of the Brownsville specimens, taken from the fresh specimen, are as follows :

No. 3787, ♀ ad. Body, 4.50 in.; tail, 5.13 ; ear, 50. No. 3786, ♀ ad. Body, 4.25 ; tail, 4.75 ; ear, 50.

The Moro Leon specimen is similar to the others except that the fawn colored lateral band is indistinct, being present only for a short distance immediately behind the fore limbs.

Our knowledge of the genus *Heteromys* is in a very unsatisfactory state. In 1815 Thompson described* a species under the name *Mus anomalus*, based on a single specimen from the island of Trinidad. In 1823 a second species was described by F. Cuvier, from North America (" Amerique septentrionale "), under the name " *Saccomys* anthophile "† These were the only forms known up to 1843, when Dr. J. E. Gray referred to a specimen from Coban, which he named‡ *Heteromys desmarestianus*, without, however, describing it. In 1868, in a paper entitled " Synopsis of the Species of *Saccomyinæ*, or Pouched Mice, in the Collection of the British Museum," he made a revision of the genus *Heteromys*,§ of which he recognized six species, adding four to those above mentioned, as follows : (1) *H. anomalus* (Thompson), from Trinidad; (2) *H. desmarestianus*, from Coban ; (3) *H. melanoleucus*, from Honduras (*lege* Venezuela *apud* Alston‖); (4)

* Trans. Linn. Soc., XI, 1815, p. 161, pl. x.
† Mem. du Mus., X, 1823, p. 419, pl. xxvi ; Dents des Mam., 1825, p. 187.
‡ P. Z. S., 1843, p. 79.
§ *Ibid.*, 1868, pp. 203–205.
‖ Biol. Centr. Am., Mam., 1880, p. 167.

*H. longicaudatus*, from Mexico ; (5) *H. irroratus*, from Oaxaca, Mexico ; (6) *H. albolimbatus*, from "Mexico? La Parda (*Feirecier*)" (*lege* "La Parada, Février, 1861," *apud* Alston, l. c.). The last three were based upon specimens collected by Sallé. It appears that these six species were founded on seven specimens, of which two were referred to *H. albolimbatus*. In the same paper (l. c., p. 202) he also described a *Perognathus bicolor*, from "Honduras," which Mr. Alston* has since redescribed as *Heteromys bicolor*, stating that its true habitat is Venezuela! In 1874 Dr. Peters† described *H. adspersus* from Panama, this making the ninth species of the genus *Heteromys*.

Mr. Alston, in 1880, in the "Biologia" (l. c.) said: "Of several described species of *Heteromys* only four appear to me to be well established—namely, *H. anomalus* (Thompson) from Trinidad, *H. bicolor* (Gray) from Venezuela, and the two following Central American forms: 1. *H. demarestianus*.... 2. *H. longicaudatus*," of which he gives colored plates. Gray's *H. melanoleucus*, *H. irroratus*, and *H. albolimbatus*, and Peters's *H. adspersus* are all synonymized with Gray's *H. longicaudatus*, since, as he says, "after a careful study, I have been quite unable to find any valid specific distinctions between the specimens" on which they were respectively based. In the same connection he takes occasion to correct a number of errors in Gray's "misleading descriptions." He points out that the characters given by Gray are not to be trusted, but he fails to give us any further information beyond a short diagnosis of less than three lines in length of the two species he proposes to recognize, the only tangible point being that *H. desmarestianus* (known only from the type specimen from Coban) is "dull chestnut brown above," and *H. longicaudatus*, "mouse-grey, more or less mixed with tawny." In view of the differences presented by the thirteen specimens before me even these alleged characters fail to have any significance.

The six specimens from Costa Rica (five from Angostura and one from Pacuare) are all without dates except the one from Pacuare, marked as taken May 16, 1876. One of the Angostura

* Ann. & Mag. Nat. Hist., 5th. Ser., VI., 1880, p. 118, 119.
† Monatsb. Ak. Berlin, 1874, p. 357.

specimens (No. 12,903) is labeled "*Heteromys longicaudatus*," with the endorsement on the back of the label, "Identified in Brit. Mus." This is entirely blackish brown above, both the hairs and the spines being of this color for about their apical half, passing gradually into dull grayish white towards the base. Below, soiled yellowish white (perhaps pure white in life). The dusky brown color of the upper surface extends down the fore limbs to the carpus, and on the hind limbs extends over the proximal third of the metatarsus. Feet sparsely haired above, naked below. Ears and tail nakedish, the latter distinctly bicolor, and the annulations plainly visible through the very short sparse hairs, which form a very slight pencil at the tip of the tail. Ears uniform blackish, without any white border. The Pacuare specimen (No. 12,907, ♂ ad.), taken in May, is almost exactly similar in coloration. In neither is there any mixture of tawny or fawn color.

No. 12,905, without date, has the pelage rather fuller and softer, of the same general color as the others, except that the blackish brown of the upper parts is everywhere mixed with pale chestnut brown hairs, finer and softer than the general pelage, and much more numerous on the sides than over the middle region, which is thus distinctly darker and less rufous than the flanks. No. 12,904, also without date, is like the last only the softer hairs are still more abundant and of a brighter or more tawny tint. In none of these specimens is there any fawn-colored lateral stripe separating the dark color of the dorsal surface from the clear white or yellowish white of the ventral surface.

The two alcoholic skins are of but little use as regards coloration, but they present points of interest in respect to the texture of the pelage, one (No. 12,906) having the pelage wholly soft, without spines, while in the other the whole dorsal region is densely clothed with heavy spines, with very scanty underfur.

I believe that these specimens are all referable to one species, which for convenience may be called *H. longicaudatus*, and that the difference in color and in the character of the pelage is due to season and age, *i.e.* that the specimen in soft pelage is young; that the two specimens without any distinct mixture of soft rufous hairs are in summer coat; and that the two, and particularly No.

12,904, with soft tawny hairs intermixed, represent the winter condition. All the specimens agree in having a practically naked tail and uniform dusky ears, in contrast with the specimens from further north with well-haired tails and white-edged ears. Unfortunately the skulls of the Costa Rica specimens are not available for comparison.

Three of the four specimens from the north (Guanajuato north to Brownsville, Texas) were taken in winter (Jan. 18 to Feb. 26); the other is without date. It agrees with the others except in lacking, as already stated, nearly all trace of the fawn-colored lateral band so conspicuous in the other three. The coat is rather thinner, and I suspect it is not in winter—at least not in midwinter—pelage. This particular specimen might be considered as representing Gray's *H. albolimbatus*. His *H. irroratus* may be the same form in thinner pelage. Without the actual types for comparison it is impossible to decide whether either are identical with the *H. alleni* of Coues.

From the foregoing I am led to the following conclusions : (1) That the material before me represents two species, one, *H.* '*longicaudatus*,' being Central American (all my specimens are from Costa Rica), and the other, *H. alleni*, Mexican, ranging from Southern Mexico (Oaxaca ?) northward to the mouth of the Rio Grande. (2) That there is much seasonal variation in color and in the texture of the pelage, the exact character of which can be determined only by a much larger amount of material, with the dates of collection carefully noted, than is now available. (3) that the "*Saccomys anthophile*" of F. Cuvier, supposed to have come from "Amerique septentrionale," was probably from Mexico, but wherever from cannot be positively identified. As urged by Dr. Peters, the genus *Saccomys* should doubtless stand as a synonym of *Heteromys*.

## **Dipodomys phillipsii** *Gray.*

*Dipodomys phillipii* GRAY, Ann. and Mag. Nat. Hist., VII, 1841, p. 522 (Real del Monte, Mexico).

*Dipodomys phillipsii* GRAY, Am. Journ. Sci., XLII, 1842, p. 335 ; List Mam. Brit. Mus., 1843, p. 120. (Same as above.)—AUD. & BACH., Quad. N. Am., III, 1853, p. 137, pl. 130 (from Gray's type).—ALLEN, Bull. Mus. Comp. Zoöl., VIII, No. 9, March, 1881, p. 187 (San Luis Potosi, Mexico). — ? TRUE, Proc. U. S. Nat. Mus., 1886, p. 410 (in part).

*Macrocolus halticus* WAGNER, Arch. für Naturgesch., 1846, i, p. 176 (Mexico.)

*Dipodomys phillipsii* ("*phillipii*" by typ. error) was originally described by Gray in 1841, as the type of the genus *Dipodomys*, here first characterized, from a specimen collected by Mr. John Phillips near Real del Monte, Mexico, a locality said to be not far from the City of Mexico. The species was figured in 1853 by Audubon and Bachman from Gray's original type. These writers also referred to it specimens from California, as was done later by Leconte, Baird, and Coues. Baird's specimens were all from California and Oregon, while Coues referred to it additional specimens from Arizona and New Mexico, and True, in 1888, referred to it also several specimens from Texas.

In 1857 Baird recognized the species of the genus *Dipodomys*, as follows: *D. ordii* Woodhouse, *D. phillipsii* Gray, and *D. agilis* Gambel. His own *D. montanus* (New Mexico) he provisionally referred to *D. ordii*, and Wagner's *Macrocolus halticus* (Mexico) to *D. phillipsii*, while he considered Leconte's *D. heermanni* (Sierra Nevada, Cal.) and *D. wagneri* ("South Carolina") as indeterminable. Coues, in 1875–77, referred all of the previously named forms to *D. phillipsii*, of which he recognized *ordii* as a subspecies.

True, in 1888, in an important paper on the genus *Dipodomys* (l. c.), showed that the specimens hitherto referred to *Dipodomys* were separable into two groups, characterized respectively by the presence or absence of a hallux, and called attention to the fact that *D. phillipsii* Gray was a four-toed form, while *agilis* Gambel was five-toed. He considered this an important specific character, and pointed out other coincident differences characterizing the two groups. He accordingly separated *Dipodomys* into two species: *D. phillipsii* and *D. ordii*, defining their respective habitats.

In 1890 Dr. Merriam* raised these two sections to the rank of genera, restricting the name *Dipodomys* to the four-toed forms, and proposing the generic name *Dipodops* for the five-toed forms. He also described as new a *Dipodops longipes* based on specimens from the Painted Desert, Arizona. A few weeks later† he redescribed *D. ordii* as *Dipodops ordii*, and described as new

* North Am. Fauna, No. 3, Sept., 1890, p. 72. † *Ibid.*, No. 4, Oct., 1890, pp. 41–49.

species *Dipodomys ambiguus* (from El Paso, Texas), *Dipodomys spectabilis* (from Cochise Co., Arizona), and *D. californicus* (from Mendocino Co., California).

Some three years previously Mr. F. Stephens* described a very distinct form from the Mohave Desert, California, as *Dipodomys deserti;* in 1888 Mr. True† added *Dipodomys compactus* from Padra Island, Nueces Co., Texas, which Mr. Thomas‡ later recognized in specimens from Duval Co., Texas, under the designation *Dipodomys agilis compactus* True. In 1890 Dr. Mearns§ described *Dipodomys merriami*, based on specimens from New River, Arizona, and *Dipodomys chapmani*, from Fort Verde, Arizona. I have recently added‖ *Dipodops sennetti* from Cameron Co., Texas.

Thus since 1886 the number of species of *Dipodomys* has been raised from two to twelve and the group separated into two genera. The species now recognized stand as follows :

I. *Dipodomys* GRAY, 1841. TYPE, *D. phillippsii* GRAY.

1. *D. phillipsii* GRAY, 1841, Real del Monte, Mexico.
2. *D. deserti* STEPHENS, 1887, Mohave Desert, California.
3. *D. merriami* MEARNS, 1890, New River, Arizona.
4. *D. spectabilis* MERRIAM, Cochise County, Arizona.
5. *D. ambiguus* MERRIAM, El Paso, Texas.
6. *D. californicus* MERRIAM, Mendocino County, California.

II. *Dipodops* MERRIAM, 1890. TYPE, *D. agilis* GAMBEL.

1. *D. agilis* GAMBEL, 1848, Pueblo de los Angeles, California.
2. *D. ordii* WOODHOUSE, 1853, El Paso, Texas.
3. *D. compactus* TRUE, 1888, Padre Isl., Nueces Co., Texas.
4. *D. chapmani* MEARNS, Fort Verde, Arizona.
5. *D. longipes* MERRIAM, Painted Desert, Arizona.
6. *D. sennetti* ALLEN, Cameron Co., Texas.

Of other names applied to animals of this group, it is probable that *Macrocolus halticus* Wagner (1846, from "Mexico") is identical with *D. phillipsii*, it being a four-toed form from Mexico ;

* Am. Nat., XXI, 1887, p. 42, pl. v.
† Proc. U. S. Nat. Mus., 1888, p. 160.
‡ P. Z. S., 1888, p. 448.
§ Bull. Am. Mus. Nat. Hist., II, No. 4, Feb., 1890, pp. 290, 291.
‖ *Ibid.*, III, No. 2, April, 1891, p. 226.

as the type was a spirits specimen in bad condition, and ultimately used as a skeleton, it will be impossible to decide the case. Leconte's *D. heermanni* (1853, "Sierra Nevada") and his *D. wagneri* (1853, "South Carolina?") are likewise entirely indeterminable from the descriptions, and the types probably are not now extant. Baird's *D. montanus* (1855, Fort Massachusetts), although described with care, can be located only on the basis of the type, if still extant; otherwise it will be well to accept Baird's own later provisional reference of it to *D. ordii.*

In view of recent developments respecting this group of Pouched Rats, it is of interest in this connection to recall the following words of Professor Baird, published in 1857:* "The colors of body and tail vary very considerably at any rate; and to continue the construction of species on the same data as guided Dr. Leconte and myself two or three years ago, would now necessitate the establishment of half a dozen new ones, to accommodate the present large collection belonging to the Smithsonian Institution."

I have before me at present 25 specimens of *Dipodomys* and 28 of *Dipodops.* These include the nine from San Luis Potosi (Coll. Mus. Comp. Zoöl.) referred by me in 1881 to *Dipodomys phillipsii.* Seven of these are four-toed, and the other two five-toed. The four-toed examples I still refer to *D. phillipsii* Gray, since they were collected not very far from the type locality of the species, and agree as well as could be expected with Gray's description and Audubon's figure. It is, however, probable that the *D. phillipsii* of Leconte, Baird, Coues, True, and most other writers is not that species, even in part, very diverse forms having evidently been included under this name. Indeed, Audubon and Bachman's description, and consequently their *D. phillipsii*, is composite, being taken in part (including the figure) from Gray's type, and in part from a specimen from "California," while their remarks on the habits and distribution doubtless relate to several species!

The seven San Luis Potosi specimens represent a form closely allied to *D. spectabilis* Merriam, which "inhabits a wide range of country," Dr. Merriam giving for it a habitat embracing south-

* Mam. N. Am., p. 414.

eastern Arizona and adjoining portions of Sonora, the southern half of New Mexico, and eastward to Sierra Blanca, Texas, the largest specimens coming from Albuquerque, N. Mexico. The length of the hind foot varies from about 45 mm. to above 55 mm. In the San Luis specimens the hind foot varies from 45–50 mm., averaging about 47.5. In coloration the chief differences appear to consist in the greater distinctness of the supraorbital spot in the San Luis series, and in the upper and lower tail stripes remaining distinct almost to the end of the tail, instead of uniting a little behind the middle. The general size is a little less, but the proportions are apparently the same.

## **Dipodops ordii palmeri,** subsp. nov.

*Dipodomys phillipsii* ALLEN, Bull. Mus. Comp. Zoöl., VIII, No. 9, 1881, p. 187 (in part).

Similar in size and proportions and in cranial characters to *D. ordii*, but much darker in coloration, being nearly as dark as the lighter colored specimens of *D. agilis*.

Above brownish ochraceous, much mixed with blackish, the hairs being plumbeous at base, subterminally broadly ringed with rather dull dark ochraceous, and rather broadly tipped with blackish. Below pure white, including the fore limbs (except a buffy ochraceous patch on the posterior surface of the fore arm), and the usual band across the thigh. Hind feet white above and on the sides, soles brownish black, a blackish half-ring at the posterior base of the heel. Tail above and below dusky brown, with the lateral white stripes narrow and extending to the end of the vertebræ, the crest and pencil at the tip dusky brown, not dusky plumbeous as in *D. ordii*. Ears large, scantily haired, with a broad dusky patch on the outer surface of the anterior border, and another terminal dusky patch on the inner surface of the lower posterior border; rest of the ear whitish.

*Measurements* (approximate from skins).—Total length, 249 mm.; head and body, 92.7; tail vertebræ, 141; tail to end of hairs, 156; hind foot, 35; ear from notch, 11.4.

Skull: Total length, 38; basal length (occip. condyles to incisors), 25.4; greatest mastoid breadth, 24; least interorbital breadth, 13.2; breadth at orbital expansion of maxillaries, 19.3; length of nasals, 11.4; length of lower jaw (condyle to tip of incisors), 17.8; height (angle to coronoid process), 5.8.

Based on two specimens (Nos. 5886 and 5887, Mus. Comp. Zoöl.), adult males, collected respectively May 1, 1878, and Sept. 1, 1878, at San Luis Potosi, Mexico, by Dr. Edward Palmer, for whom the subspecies is named.

These two specimens, although one was collected in May and the other in September, present no appreciable differences in coloration or other external features. As regards size and cranial characters they closely resemble an El Paso specimen of *D. ordii* (No. $\frac{18142}{25040}$, Dept. of Agriculture, ♂ ad.), kindly loaned me by Dr. Merriam.* They are, however, much darker, with the lower portion of the tibia blackish instead of ochraceous, etc. They thus resemble quite as closely light colored examples of *D. agilis* from San Diego Co., California.

## **Dipodops richardsoni,** sp. nov.

Similar in coloration and general external features to *Dipodops ordii* but much larger, and with important cranial differences.

Above bright ochraceous-buff, strongly varied with blackish-tipped hairs, passing into reddish ochraceous buff, less varied with black, on the sides. Hind limbs externally as far as the heels, colored like the sides of the body; fore limbs everywhere pure white, or more or less suffused with bright yellowish buff on the outer surface as far as the wrists. Thigh band, a large spot over each eye, the whole lower surface of the body and the inside of the limbs pure white. Tail above and below at the surface plumbeous black to the tip, the hairs mixed with white basally; lateral white stripes pure white, narrow at the base of the tail and gradually widening to the tip, and extending to considerably beyond the vertebræ. Ears within ochraceous, mixed with blackish on the apical third, forming an indistinct dusky spot; externally whitish, passing into buff, or buff mixed slightly with dusky on the superior border.

*Measurements* (approximate from skins): Total length, 289 mm.; head and body, 114.3; tail to end of vertebræ, 144.8; tail to end of hairs, 174.5; hind foot, 40.6; ear from crown, 10.7.

Skull: Total length, 40.6; basal length, (condyle to incisors), 28.2; greatest mastoid breadth, 25.9; greatest malar breadth, 22.4; inter-lachrymal breadth, 13; length of the intermastoid area, 5.1; length of anterior border of same, 3.6; do., posterior border, 3; length of nasals, 14.7; length of lower jaw (point of incisors to tip of condyle), 20.8; height (angle to condyle), 7.6.

Type, $\frac{3025}{2345}$, ♂ ad., Beaver River, Ind. Terr., Oct. 26, 1887, Jenness Richardson and John Rowley, Jr.

The present species is represented by a series of 14 specimens, collected by Messrs. Richardson and Rowley (Museum Expedition of 1887) in the Indian Territory, Oct. 12–26, 1887, the exact locality being on one of the sources of the Beaver River in the

* See North Am. Fauna, No. 4, 1890, p. 45.

extreme northwestern corner of the Territory, in the so-called 'Neutral Strip.' The series is very uniform in respect to coloration, the general color varying but little; some specimens are a little paler or a little brighter than others. While the fore limbs are generally white, a number of specimens have the lower portion of the external surface of the fore-arm more or less buffy, varying from a slight tinge of this color to a conspicuous suffusion over a considerable area. The dark stripe on the lower surface of the tail is also variable in extent, in some specimens running to the end of the tail, in others not passing beyond the basal half.

This species finds its nearest allies in *D. sennetti* of Southeastern Texas, and *D. ordii* of Southwestern Texas, from both of which it differs externally in larger size and somewhat brighter colors. In cranial characters it resembles the former in the robust development of the rostral portion of the skull, and the latter in the greater inflation of the mastoid elements, and the consequent reduction of the intermastoid area. Thus while *D. richardsoni* is much larger than either, it combines the cranial features of both, very much as if the anterior half of the skull of *D. sennetti* had been grafted on to the posterior half of the skull of *D. ordii*.

The fine series of skulls of *D. richardsoni* furnishes a fair test of the individual variability of cranial characters in this group. The variation in size between adults is very slight; the same is also true in respect to the general form of the skull. The only noteworthy variation is in the size of the intermastoid area and the size and form of the interparietal bone. The intermastoid area is subquadrate, with the lateral borders slightly concave, and the anterior border slightly longer than the posterior. Its least breadth varies in different skulls from .06 to .15 in., and its length from .20 to .24. The largest and the smallest of the series present the following dimensions: .15 x .24 in. and .26 x .20.

These variations are shown in the accompanying illustrations (Figs. 1 to 4). The skulls fall into two series in respect to the breadth of the intermastoid area, three having this area very narrow, as shown in Fig. 4; in the other eleven it is broader, as shown in Figs. 1 to 3. These four figures illustrate also the extreme variability of the interparietal, as regards both its size

and form. The variability in coloration above mentioned is not in any way correlated with the variation in the skulls, and is hence in each case doubtless purely individual. It should be further noted that age has nothing to do with the variability of the intermastoid area, this space being relatively the same in skulls not full-grown as in those fully adult.

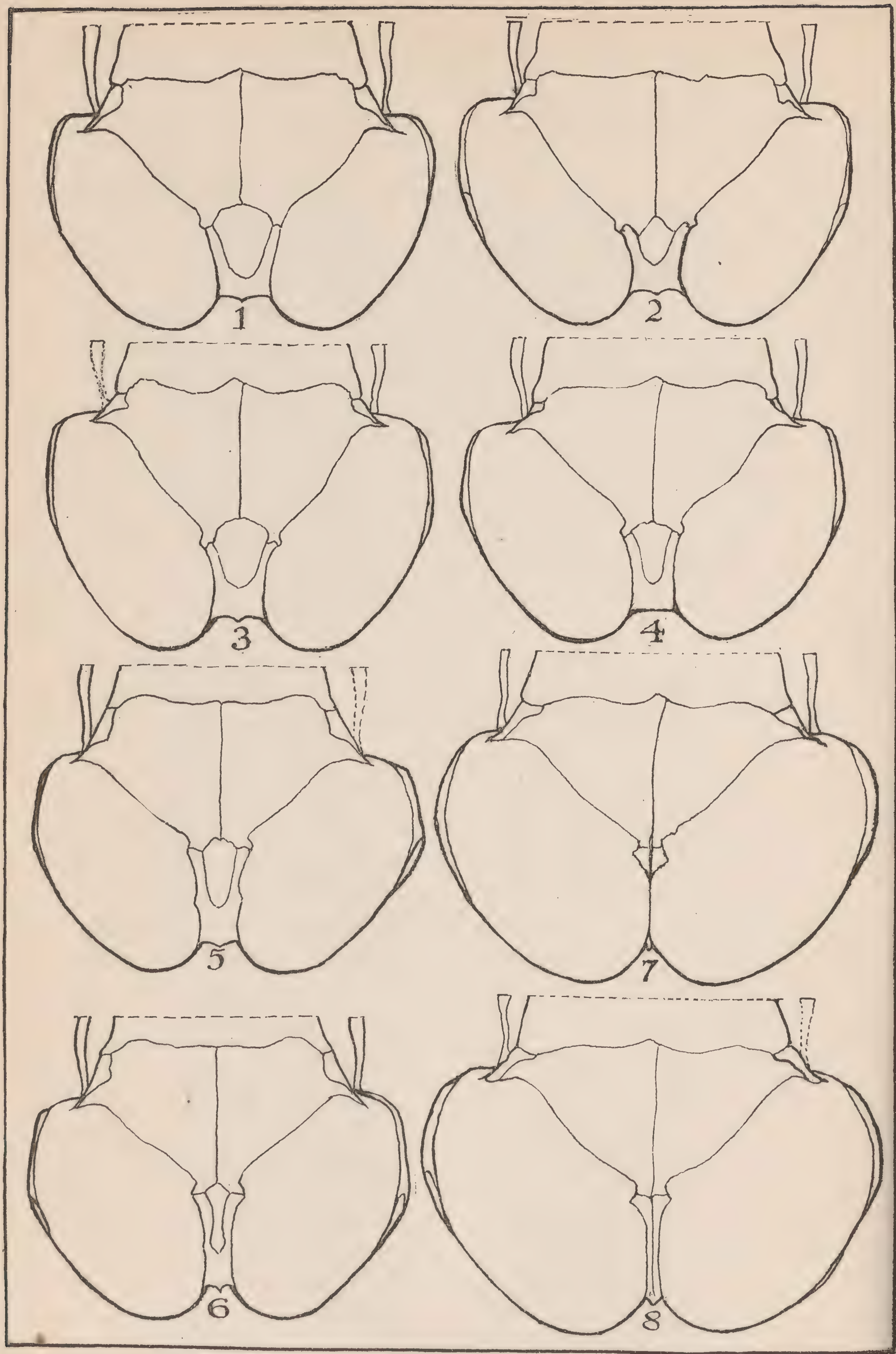
In addition to the series above mentioned I refer to this species a single specimen (♀) from Trego County, Kansas, collected May 7, 1889. It is smaller and paler than the fall specimens from the Indian Territory. (The skull of this specimen has been unfortunately mislaid.) Another specimen from Estes Park, Larimer County, Colorado, collected Feb. 8, 1889, I am unable to distinguish by any feature, cranial or external, from average specimens of the Indian Territory series. In all probability the species will be found to range over the Plains from northern Texas to southern Wyoming and westward to the Rocky Mountains.

The species is named for Mr. Jenness Richardson of the American Museum of Natural History, whose explorations under the auspices of the Museum have added much valuable material to our collections and thrown much light on the distribution of North American mammals.

Of interest in relation to individual variation in cranial characters, are Figs. 7 and 8, showing the extremes of variation in a series of six skulls of *Dipodomys deserti.* In Fig. 7 the inflated mastoids meet on the median line, while in Fig. 8 they are slightly separated. Figs. 5 and 6 show the extremes of variation in a series of seven skulls of *Dipodops agilis.*

*Explanation of the Figures.*

| | | |
|---|---|---|
| Fig. 1, | Dipodops richardsoni, | No. 2339, ♂ ad. |
| " 2, | " " | No. 2338, ♂ ad. |
| " 3, | " " | No. 2344, ♀ ad. |
| " 4, | " " | No. 2345, ♂ ad. |
| " 5, | Dipodops agilis, | No. 2604, ♂ ad. |
| " 6, | " " | No. 2652, ♂ ad. |
| " 7, | Dipodomys deserti, | No. 2599, ♂ ad. |
| " 8, | " " | No. 2600, ♂ ad. |




1–4, Dipodops richardsoni; 5, 6, Dipodops agilis; 7, 8, Dipodomys deserti.

(*Twice natural size.*)

## **Perognathus (Chætodipus) femoralis,** sp. nov.

Coloration nearly as in *Heteromys alleni;* the pelage less bristly ; ears smaller, and tail longer.

Above prevailing tint blackish, faintly suffused with pale grayish buff, more pronounced on the sides, and bounded below by a broad lateral line of dull orange buff. The pelage of the whole dorsal surface consists of coarse hairs and bristles without underfur ; the bristly hairs are pale grayish plumbeous basally, subapically broadly ringed with pale buff and tipped with black ; they are mixed with coarse grooved spines, some of which are wholly black and others wholly pale buff. Below, whole fore limbs, and inner surface of the hind limbs nearly to the tarsus, white ; no light eye-ring nor light spots at base of ears ; outer surface of hind limbs blackish to the feet, with long conspicuous yellowish white bristles on the thighs ; upper surface of hind feet grayish white; tail sharply bicolor, blackish above and at the tip, grayish white below, sparsely haired and scaly on the basal third, apical third with long hairs and a heavy bushy pencil at the tip.

*Measurements* (taken by collector before skinning) : Total length, 241 mm. ; head and body, 89 ; tail to end of vertebræ, 133 ; to end of hairs, 152 ; ear, 9.4 ; hind foot (from skin), 27.

Skull : Total length, 27.4 ; basal length (condyle to incisors) 20.8 ; mastoid breadth, 16.7 ; zygomatic breadth, 13.2 ; least interorbital breadth, 7.6 ; length of nasals, 11.2 ; interparietal, 8.6 x 4.6 ; lower jaw, length, 14.7, height (at coronoid), 5.3.

Type, No. $\frac{3386}{2659}$, ♂ ad., Dulzura, San Diego Co., California, Feb. 12, 1891.

This species combines the external appearance of a typical *Heteromys* with the cranial characters of *Perognathus*, it having the coloration and the hispid pelage of the former and the swollen mastoids and dentition of the latter. *P. femoralis* finds its nearest relatives in *P. californicus* and *P. armatus* Merriam, but it differs so much in both size and coloration from either as to require no detailed comparison with them.

The subgenus *Chætodipus* differs from the subgenus *Perognathus* in the direction of *Heteromys*, the present species in external characters presenting a striking resemblance to *Heteromys alleni*, from which it differs mainly in smaller size, relatively shorter and more penicillate tail, and smaller ears. In cranial characters, however, the two forms are widely different.

## **Neotoma micropus** *Baird.*

(Texan Wood Rat.)

*Neotoma micropus* was described by Baird* in 1855 from two specimens collected at Charco Escondido and Santa Rosalia, in northeastern Mexico, not far from Matamoras, and redescribed in 1858† from the same specimens. In 1877 Dr. Coues referred‡ *N. micropus* to *N. floridana*, after an examination of the original specimens. He says: "The case of *Neotoma 'micropus'* presents some difficulty, owing to lack of material; we have nothing additional to Professor Baird's two types. One of these, No. 561, is so young, that the molars are not cut at all! the skull measuring only 1.08, or about half the normal adult average. We will, therefore," he adds, "confine our attention to the other specimen, No. 554. This has the appearance of being mature, or nearly so, except that it is, as stated, in a grayish-slate state of pelage."

In a collection of mammals recently received by the American Museum from Brownsville, Texas—a point about sixty miles east of the original locality—are eleven specimens of a *Neotoma* which at once attracted attention by their "grayish-slate" colored pelage, they being strikingly different from anything I had previously seen, with the exception of three specimens received last year from the extreme northwestern corner of the Indian Territory, presently to be mentioned at length. On comparing the Brownsville specimens with Baird's description of his *N. micropus* it became immediately evident that they were referable to this long lost species, so well characterized at all ages by its slaty gray coloration.

As shown by Dr. Coues, some of the alleged characters of *N. micropus* were elusive, as the supposed smallness of the feet and the disproportionately short tail; also that certain supposed cranial differences are shared by the western forms of the *N. floridanus* group. "The chief character of 'micropus,'" says Dr. Coues, "rests upon the assumption that the gray pelage No. 554 shows is permanent. Although this presumption is

* Proc. Acad. Nat. Sci., Phila., VII, 1853, p. 333.
† Mam. N. Am., p. 492.
‡ Mon. N. Am. Roden., p. 15.

colored by Dr. Berlandier's testimony,* that naturalist is as liable to be mistaken as another one; and we are satisfied that *Neotoma* 'micropus' is not a valid species."

The Brownsville specimens prove that the slate-gray pelage is not due to immaturity, the skulls showing them to be all adult except one, while the six females give evidence of having suckled young.

The collector's measurements of the ten adult specimens from Brownsville are as follows: Total length, 360 mm.; head and body, 209; tail, 151; ear, 18.

As regards coloration, there is nothing to add to Baird's description. In respect to cranial characters, there are two points to be noted, namely, the heavier dentition and much broader molars, and the less posterior prolongation of the intermaxillaries (as compared with the nasals) in *N. micropus*, in comparison with *N. floridana*.

Since writing the above I have found three additional specimens of *N. micropus* in Mr. Sennett's collection, obtained by one of his collectors (Mr. J. M. Priour) at San Fernando de Presas, in the State of Tamaulipas, about fifty-five miles due south of Charco Escondido. They were collected March 30, 1888; one is an adult male, one an adult female, and the other a not quite adult female. They agree exactly in coloration with the Brownsville specimens, but are apparently rather smaller; the distorted condition of the skins, however, prevents satisfactory comparison as regards measurements. The size of the ears and feet are practically the same as in the Brownsville specimens.

In Mr. Sennett's collection I find also a two-thirds grown male from near Perry's Landing, Brazoria County, Texas, about fifteen miles from the mouth of the Brazos River, collected May 22, 1887, which agrees so closely with the Tamaulipas examples that I have little hesitation in referring it to the same species.

*Neotoma micropus* has thus an ascertained range extending from the San Fernando River in Tamaulipas northward to Brownsville, Texas, and probably along the coast of Texas to the Brazos River. There is nothing to show how far it may range to

* *Cf.* Baird, Mam. N. Am., p. 494.

the westward, except that the form occurring in Presidio County, Texas, is *N. mexicana*, as shown by a fine adult specimen in Mr. Sennett's collection, taken Oct. 15, 1887, by Mr. Wm. Lloyd.

Since the above was prepared for the press, Mr. Frank M. Chapman, of the American Museum, has returned from a short collecting trip in Texas, bringing with him, as a part of his collection, 17 specimens of *N. micropus* taken at Corpus Christi, March 21 to April 8, 1891. They are all adult but one, are very uniform in coloration, and agree exactly in this respect with the Brownsville and other specimens already mentioned. Taking the whole series of 30 specimens together, the uniformity of coloration is remarkable. The portion of the year represented extends from January to June.

Twelve Corpus Christi specimens, 6 females and 6 males, all fully adult, average as follows, from measurements taken by Mr. Chapman from the fresh specimens: Total length (nose to end of vertebræ), 360 mm.; head and body, 222; tail vertebræ, 138; hind foot, 39. The males average slightly larger than the females. The length of the tail (vertebræ alone) varies in different fully adult specimens from 137 to 156 mm.

The following observations on the habits of this animal are kindly furnished by Mr. Chapman.

"The Texan Wood-rat (*Neotoma micropus*) is very abundant in the vicinity of Corpus Christi. In suitable localities, the densest of low, scrubby chapparal, one or more nests of this species were always in view, and it was not unusual to find their dwellings beneath some isolated bush or cactus in the prairie. These nests are rude structures, composed of dried horse and cow excrement, sticks and weed-stalks piled together until the whole has assumed an irregularly pyramidal form. They average from two to three feet in height, and have a basal diameter of from three to four feet. There are from two to five openings which lead to the nest proper, a mass of soft, dried grass, situated near the centre of the house, or in one of the chambers which are sometimes excavated beneath it. Long *Opuntia* spines, cut from the growing leaf, are placed about these openings, evidently to prevent the entrance of unwelcome visitors.

"The food of *Neotoma*, so far as I learned during my observations in March and April, consisted of the thick, fleshy leaves of the prickly pear (*Opuntia* sp.), the common cactus of the region. These they ate on the growing plant, and there were few cacti in the vicinity of their haunts which did not show more or less recent evidence of their fondness for its leaves.

"*Neotoma* is nocturnal in its habits and passes the day in retirement in its dwelling, whence it may be aroused by vigorous use of a stick pushed into one of the entrances or through the nest itself. On being thus driven from its nest it takes refuge in a neighboring one.

"It is difficult to say whether one or more pairs inhabit the same dwelling, though it is not improbable their homes may be divided into apartments. Within five days I trapped, at the same nest, four adult specimens of both sexes, catching one each night; and I was told that seven adults have been taken from one nest.

"From two to four young are produced at a birth. Of six adult females taken from March 20 to 30, three were nursing and three contained two, three and four large fœtuses, respectively.

"The abundance of this animal has given rise to a peculiar form of sport among the youth of Corpus Christi. Armed with sticks and accompanied by dogs of various kinds, they visit the chapparal, start the rats from their homes, in the manner previously described, when the dogs generally catch them as they attempt to escape. A more practical method of capture, however, is to place a No. o steel-trap at the mouth of an opening to the nest. The rats are apparently unsuspicious, and the trap may be set without any attempt at concealment."—CHAPMAN, *MS. Notes.*

It seems remarkable that an animal so abundant and so easily captured, and having furthermore so wide a distribution, should have escaped the observation of naturalists for a period of thirty-five years! during which period *Neotoma micropus* was practically a 'lost' species.

### **Neotoma micropus canescens,** subsp. nov.

(PALLID WOOD RAT.)

Four fine adult specimens from the northwestern corner of the Indian Territory resemble the Brownsville and Tamaulipas series,

except that they are much paler and grayer. These examples were taken by Messrs. Richardson and Rowley, of the American Museum, on the North Beaver River, near the boundary line between the Indian Territory and New Mexico, Oct. 17–20, 1889, and consist of three skins and skulls and a specimen in alcohol. While evidently allied to *N. micropus*, they appear to represent an easily recognizable form, characterized by pallid coloration. It may be described as follows:

Similar to *N. micropus* but much paler, the upper parts ashy gray instead of dusky slate gray, with a much less admixture of black. Below whiter, the hairs being pure white to the base instead of plumbeous with the apical portion only white. The sides of the body are much paler and more ashy. The upper surface of the tail is ashy brown instead of nearly black. The faint fulvous tinge of the upper surface in adult specimens of *N. micropus* is almost entirely absent in *canescens*.

Judging from the skulls there is little difference in size, the Brownsville specimens being a little the largest of the whole series.

The alcoholic specimen (♂ ad.) of *N. m. canescens* measures as follows: Total length, 340 mm. (13.3 in.); head, 54 (1.37); head and body, 205 (7.05); tail, 135 (5.32); fore foot, 19 (.75); hind foot, 38 (1.50); ear from crown, 25 (.98), from notch, 23 (.91).

MEASUREMENTS OF SKULLS OF *Neotoma micropus* AND *N. micropus canescens*.

| No. | Locality. | Sex and Age. | Total Length. | Basal Length. | Breadth. | Nasals. | Lower Jaw. | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Length. | Breadth. |
| 2622/3343 | Brownsville, Texas | ♂ ad. | 49.8 | 46.2 | 24.4 | 18.5 | 33.0 | 14.7 |
| 2621/3342 | " | ♀ ad. | 48.8 | 45.7 | 25.9 | 19.3 | 32.3 | 14.7 |
| 2619/3340 | " | ♂ ad. | 49.0 | .... | 26.4 | 19.8 | 34.5 | 15.6 |
| 2746/3498 | San Fernando de Presas, Tamaul. | ♂ | 44.7 | 40.6 | 24.6 | 17.3 | .... | .... |
| 2745/3497 | " " | ♀ | 45.2 | 40.6 | .... | 17.0 | .... | .... |
| 2350*/2330 | Indian Territory | ♂ | 49.0 | 45.7 | 27.4 | 20.3 | 34.3 | .... |
| 2351*/3031 | " | ♀ | 46.7 | 44.7 | 25.4 | 18.5 | 31.2 | 15.4 |
| 2352*/3032 | " | ♂ | 44.6 | 41.9 | 25.4 | 17.3 | 29.7 | 14.2 |

* *Neotoma micropus canescens.*

The variation shown in the above table is partly individual but mainly due to differences of age. The two San Fernando speci-

mens are shown by the skulls to be slightly immature, although the skins have the appearance of being those of fully grown individuals.

It is important to note in the present connection that specimens from Central Kansas (Fort Riley, Dr. W. A. Hammond, U. S. National Museum), taken in spring and therefore comparable with the Texas specimens, are very unlike the Texas specimens, but, on the other hand, are almost indistinguishable in coloration from Florida specimens. The tail, however, is much more hairy and rather more sharply bicolor, as noted by Dr. Coues.*

## Neotoma cinerea occidentalis (*Baird*).

A recent comparison of considerable material of the *Neotoma cinerea* group shows clearly that the Northwest Coast form is at least subspecifically separable from true *cinerea* from the Rocky Mountains, as long since pointed out by Professor Baird. Dr. Coues, in reviewing the group in 1877,† was compelled to thus summarize the case of the *N. cinerea* group: "We may, in a rude way, throw the *Neotoma* [*cinerea*] skins before us into three heaps: first, the Arctic ones, thickly clad, short-tailed, dark-colored; secondly, the United States prairie [and Rocky Mountain] ones, thinly clad, short-tailed, bright-colored; thirdly, the Pacific-coast ones, medium clad, long-tailed, dark-colored. If there be more than one 'species,' there certainly are *three*," etc. He preferred, however, to recognize but one.

## Sigmodon hispidus texianus (*Aud. & Bachm.*).

*Arvicola texiana* AUD. & BACH. Quad. N. Am., III, 1853, p. 229, pl. cxlvii, fig. 2.

*Sigmodon berlandieri* BAIRD, Proc. Acad. Nat. Sci. Phila., 1855, p. 333; Mam. N. Am., 1857, p. 504; U. S. & Mex. Bound. Surv., II, 1859, p. 44, pl. v, fig. 2, 2*a*.

*Sigmodon hispidus berlandieri* ALLEN, Bull. Am. Mus. Nat. Hist., II, 1890, p. 186 (in part); *ibid.*, III, 1891, p. 207 (in text); *ibid.*, p. 224.

A series of ten specimens of *Sigmodon*, collected by Mr. Frank M. Chapman at Corpus Christi, Texas, in March and April, 1891,

* N. Am. Roden., p. 16.
† *Ibid.*, p. 28.

and just received at the Museum, has led to an examination of the status of Audubon and Bachman's *Arvicola texiana*, hitherto currently synonymized with *Sigmodon hispidus.* These authors state that "This was first discovered on the river Brazos, and afterwards seen in the country along the Nueces and Rio Grande, where chapparal thickets afford it shelter." Their description, taken with the habitat and peculiar haunts of the Texan Cotton Rat, in the light of the present large series of specimens (about 130) now available for examination, render it evident that *Arvicola texiana* is the same animal that Professor Baird, two years later, named *Sigmodon berlandieri.* Indeed, Baird himself in 1857 (l. c.) referred to its resemblance to *Arvicola texiana*, and suggested that it "may possibly be the same." Although the type of *S. berlandieri* came from "west of San Antonio," Baird referred to the same species specimens from "Eastern Texas" and northeastern Mexico.

Mr. Chapman contributes the following interesting field notes on the form here under consideration :

"The Texas Cotton Rat (*Sigmodon hispidus texianus*) is an abundant and very generally distributed mammal in the vicinity of Corpus Christi. In habits it so closely resembles *Arvicola riparius* that *Sigmodon* may be said to represent *Arvicola*, so far as its place in the animal economy of a region is concerned.

"Their favorite haunts are open swamps and meadows, where they share with *Oryzomys* the numerous well-worn runways which thread the heavier grass and reeds at the borders of ponds and bays. While occasionally they will take to water, they are much less aquatic than *Oryzomys*.

"So abundant are these animals in the salt marshes of Nueces Bay that in one night, with ten No. o traps, I captured nine individuals. They are both diurnal and nocturnal, and for this reason greatly interfere with successful trapping of purely nocturnal mammals. Traps set in the morning may all be sprung by *Sigmodon* before nightfall.

"In the chapparal and cleared fields or pastures *Sigmodon* is not uncommon, but is by no means so abundant as in the marshes.

"Their nests are composed of short, dried grasses, and are placed on the surface of the ground beneath a clump of dense grass, or

where a low-growing bush or cactus affords them opportunity for concealment.

"None of the females taken were pregnant or showed signs of nursing."—CHAPMAN, *MS. Notes.*

## **Oryzomys aquaticus,** sp. nov.

Ten specimens of *Oryzomys* from Brownsville, Texas, collected Feb. 22–March 6, 1891, differ greatly from *O. palustris* both in size and coloration, averaging three inches longer in total length, and being yellowish brown instead of reddish brown above, and buff instead of clear white or grayish white below. Notwithstanding the larger general size, the feet are much smaller than in *O. palustris.* This very distinct form may be characterized as follows:

Above yellowish brown, darker and sparsely lined with blackish mesially, passing into pale yellowish brown on the sides; below buffy, varying in different specimens from dull buffy white to strong buff. Feet, ears, and tail as in *O. palustris*, but rather paler, especially the latter, which is grayish above instead of blackish.

Average measurements of ten specimens (from the fresh specimen by the collector): Total length, 284 mm.; head and body, 140; tail vertebræ, 144; ear, 10. The corresponding average measurements of ten specimens of *O. palustris*, from South Carolina and Georgia (by Professor Baird* from alcoholics) are as follows: Total length, 209; head and body, 103; tail vertebræ, 106; ear, 13.† The hind foot (measured from skins in both instances) averages 31.7 in full-grown *O. aquaticus* against 34.3 in *O. palustris.*

The skulls are unfortunately too imperfect for satisfactory measurement, the collector having cut away the whole basal portion. Compared with *O. palustris* the skull of *O. aquaticus* is much larger and heavier; the lower jaw is much more massive; the dentition is also much heavier, the molariform teeth being nearly twice as large as in old skulls of *O. palustris.*

Type, No. $\frac{3411}{2684}$, ♂ ad., Brownsville, Texas, March 6, 1891.

The relationships of this form, both to the northward and southward, cannot at present be determined, owing to lack of material. The large pale form reported from Kansas by Dr. Coues (Mon. N. Am. Roden., p. 116) may be related to the present form rather than to *O. palustris.* The specimen from Tonila, State of Jalisco,

* Mam. N. Am., p. 484.

† The apparent difference in the size of the ear is shown by comparison of specimens of the two forms to be due to different methods of measurement.

Mexico, formerly referred by me to *O. couesi*, resembles the Brownsville specimens so closely as to be distinguishable mainly by its ventral surface, which is nearly pure white instead of being strongly suffused with buff. It may be, however, that the strong buffy suffusion of the Brownsville specimens is in part seasonal, it probably changing by fading and abrasion to nearly white toward the end of the breeding season.

Just what *H.* (*O.*) *couesi* is cannot readily be determined. It seems to agree fairly well with the present species in size and proportions, but not in coloration. The original diagnosis says: "*Upper parts reddish brown*, the fur.... with broad *rufous tips*, mixed with longer blackish hairs; the flanks *lighter rufous*, gradually shading below into dirty white (or pale fawn) without any distinct line of demarcation; *breast washed with rufous*," etc. The phrases italicised in the above quotation could never be applied to *O. aquaticus*. It seems doubtful whether *H. couesi* is an *Oryzomys* in a strict sense, as Mr. Alston says the "teeth are typically Hesperomine," and "the palate not produced so far back" as in *O. palustris*. Yet, in the 'Biologia' (Mamm., p. 143) he has placed it under *Oryzomys* with *O. palustris*.

It should be further noted that both Coues (l. c., p. 116, footnote) and Alston (Biologia, Mamm., p. 148) have recognized what they call *O. palustris* from Southern Mexico. Dr. Coues's specimen, now before me, I find is quite different from either *O. palustris* or *O. aquaticus*, resembling the latter, however, in coloration more than the former.

## **Hesperomys indianus** *Wied.*=**Mus musculus** *Linn.*

*Hesperomys indianus* WIED, Wiegmann's Arch. für Naturg., 1862, i, p. 111.

Wied speaks of this mouse as common in the fields and thickets about New Harmony, in Indiana, where he observed its tracks in the snow in the month of January. In describing it he compares it especially with the common house mouse of Europe, from which he thought it differed in having a smaller head. The type (No. 575, Am. Mus. Nat. Hist.) is fortunately still extant, and in a good state of preservation, in the Maximilian collection, and proves on examination to be nothing more than a common house

mouse (*Mus musculus*), though slightly more rufescent than average examples of this species. The original label reads as follows: "*Hesperomys indianus* Wied. N. America, Indiana." It is a mounted skin, without skull.

## On the Generic Name *Hesperomys*, and the Specific Name *leucopus*, as applied to certain North American Muridæ.

**The Generic Name Hesperomys not entitled to Recognition in Nomenclature.**—While *Hesperomys* has had currency for fifty years it proves on critical examination to have no substantial basis as a generic name. Its applicability, even if entitled to recognition, to any North American species, has long been held in question, but no one seems to have had the courage to break away from current usage and reject it as strictly untenable in such a connection. Its continued use has in the meantime increased the embarrassment of discarding it, as sooner or later must be done if strict adherence to well-established laws of nomenclature is to be observed.

*Hesperomys* antedates by three years the promulgation of the Stricklandian Code of Nomenclature. It is thus perhaps not strange that Waterhouse in proposing *Hesperomys* in 1839* should have formed it of five of his own 'subgenera,' proposed two years earlier, plus two of still earlier date, namely *Scapteromys*, *Oxymycterus*, *Abrothrix*, *Calomys*, and *Phyllotis* Waterhouse,† and *Neotoma* and *Sigmodon*, and also including '*Mus leucopus*' of North America. Subsequent writers have attempted to compromise the matter by accepting *Hesperomys*, in a generic sense, as the general name for a group, to include the others in the sense of subgenera, without, however, being able to designate any species, or even section, as typically representing *Hesperomys*. We thus have the anomaly of a 'genus' antedated by a large number of its 'subgenera,' with no section to which *Hesperomys* in a restricted sense can be applied. Various attempts have been made to 'fix' *Hesperomys* proper, but obviously, from the nature of the case, without success. Baird and Coues have each wrestled with the problem in its relation to our North American Vesper or White-

* Zoölogy of the Voyage of the Beagle, I, pt. ii, 1839, p. 75.
† P. Z. S., 1837, pp. 20, 21 and 28.

footed Mice; they both succeeded in showing the inapplicability of the name *Hesperomys*, in a strict generic sense, to any of them, and then finally adopted it for just this group, plus possibly some allied South American forms. Having done this Baird* proceeded to separate under *Hesperomys* several North American subgenera, as *Onychomys* and *Oryzomys*, leaving the *leucopus* group to compose the North American representatives of a restricted *Hesperomys*, to which it had originally only a casual relation. Later Dr. Coues† adopted Baird's new subgenera, and completed the demolition of *Hesperomys* as a North American group by proposing the subgenus *Vesperimus* for the North American species left in it by Professor Baird. Yet as *Onychomys*, *Oryzomys*, and *Vesperimus* were recognized only in a subgeneric sense *Hesperomys* was still retained as a sort of wrapper to enclose and bind them together.

From the foregoing historic summary it is evident that *Hesperomys* has no nomenclatural claims upon any of the North American Muridæ. Dr. Coues in laboring to bolster up such a claim unwittingly exposed its absurdity.‡ As we have now gotten rid of *Hesperomys*, and have names already at hand, and of unequivocal application, for our North American species, there is nothing in the way of their adoption. Although *Vesperimus*, *Onychomys*, and *Oryzomys* were each proposed in a subgeneric sense, the two latter have of late, almost by common consent in this country, risen to the rank of genera, which necessarily leaves *Vesperimus*§ on the same plane.

* Mam. N. Amer., 1857, p. 453.

† Proc. Acad. Nat. Sci. Phila., 1874, pp. 176–178.

‡ He says: "We have only to tie this name [*Hesperomys*] down to the strict value of a genus, pin it to its type, and establish among the numerous species what subgeneric divisions we can. From the circumstances of its founding it is difficult to say what should be considered the type of *Hesperomys*. Waterhouse, in drawing his comparisons between *Mus* and the New World mice, took *M. rattus* and *M. bimaculatus* for such purpose; we may properly therefore elect the latter as technically the type. But when Waterhouse, in 1837, established *Calomys* upon *C. elegans* he included in it both *bimaculatus* and *gracilipes*; and *Eligmodontia* of F. Cuvier is strictly coequal. It becomes a question whether one of these names should not stand in place of *Hesperomys* as restricted; but as the latter is firmly established, as *Calomys* is by the same author, and as *Eligmodondia* is no earlier, there may be no necessity for a change. Resting then upon this strict application of *Hesperomys* to such species as *bimaculatus*, *elegans*, and *gracilipes* [all referred to *Calomys* two years before *Hesperomys* was established!], we may enquire how nearly, if at all, the North American Vesper-mice agree with it." He then proceeds to adopt Baird's subdivisions of *Hesperomys*, and to establish *Vesperimus* for the remaining species, adopting *Hesperomys* as a blanket for the whole group!

§ As the common White-footed Mouse of Eastern North America appears to have been named *Musculus leucopus* by Rafinesque (Am. Month. Mag., III, p. 446, Oct., 1818) in 1818, Dr. Coues (Mon. N. Am. Roden., p. 46) has urged that the generic name *Musculus*, "in strict technical conformity with the rules of nomenclature, ought to be adopted" in place of *Vesperimus*, but consented to waive its claims on what he regarded as weighty considerations. While the objections he raised against it have some weight, they are fortunately not the only ones, as *Musculus* was employed for a genus of Mollusks by Klein (Tent. Meth. Ostrac., 1753, p. 127) in 1753. As Klein's names, like Brisson's, are now considered available, Rafinesque's name may be rejected as preoccupied and therefore untenable.

In regard to the status of the name *Hesperomys*, it is gratifying to find that the conclusion here reached has recently been very ably supported by Mr. Oldfield Thomas, who, in urging the essential identity of *Cricetus* with the group so long known under the name *Hesperomys*, says: "This change, large as it is, will be rendered rather less unacceptable by the consideration that the name *Hesperomys* has itself, by the strict laws of nomenclature, no possible claim to adoption, being antedated not only by *Calomys*, Waterh., and the other earlier names of the same author, and by *Eligmodontia*, F. Cuv., but also by *Akodon*, Meyen, founded on a now almost unrecognizable specimen belonging to Waterhouse's subgenus '*Habrothrix*.' That this name would have been brought up and forced into use may be looked upon as certain, and in fact the first step has been taken by the substitution of *Akodon* for *Habrothrix* in Trouessart's list of Rodents."*

I regret much, however, my inability to agree with Mr. Thomas in his conservatism in respect to genera, or rather that he should have carried his conservatism to the verge of absurdity by bringing under one generic name the Cricetine Muridæ of the Old World and the Hesperomine or Sigmodont forms of the New World. While a much closer affinity has been shown by Mr. Thomas to exist between these forms than had been previously generally recognized, it does not follow therefrom that the proposed change of nomenclature is either necessary or even warranted, much less advisable. Convenience must to some extent be considered in classification as well as in nomenclature, the two together being a means to an end. *Cricetus*, in the present Thomasian sense, is made to include not only a large number of Old World forms, but probably not less than 100 'good species' in America alone, a number of which represent groups each of which contain numerous strongly-marked subspecies, the whole aggregating from probably 200 to 250 nameable forms. It is generally conceded that classification is intended to express relationship, and that the various grades of groups, from subspecies up to the higher groups, are intended to indicate degrees of relationship. *Cricetus*, as thus constituted, includes at least a dozen 'subgenera,' many of which have been often accorded the rank of genera. The

* P. Z. S., 1888, p. 134.

assemblage thus includes very diverse elements, although the extremes are connected by gradual stages, with only here and there well-marked breaks. But is it conducive to exact expression of relationship to designate respectively *Oryzomys palustris* and *Cricetus frumentarius* as *Cricetus palustris* and *Cricetus frumentarius?* If we wish to be more exact than this in expressing in nomenclature the relations of the heterogeneous elements making up this wilderness of forms we must necessarily adopt a trinomial form of nomenclature by the introduction of the subgeneric name (in parenthesis) between the generic and specific names, resulting, in the case of subspecies, in a quadrinomial name with one of its elements enclosed in parenthesis.

On the other hand, does it tend to place in clearer light the relationship of such genera as *Tylomys*, *Neotoma*, and *Sigmodon* to the other Sigmodont mice by leaving them out of the *Cricetus* assemblage while *Onychomys*, and especially *Oryzomys*, is included in it, and the whole set in apposition as a generic group against *Tylomys* or *Neotoma?*

So far as North American forms are concerned I must confess myself content, for the present at least, to treat *Vesperimus*, *Onychomys*, and *Oryzomys* as genera, in deference not only to convenience as regards the nomenclature of their respective constituents, but as regards explicitness in defining their actual relationships.

There doubtless never will be unanimity among naturalists respecting the exact measure of a generic group; the lumpers and splitters will naturally disagree in reference to genera and subgenera just as they do on species and subspecies. While a blunt tool may satisfy the one class, only a keen one will meet the necessities of the other.

**The Specific Name leucopus, as applied to the White-footed Mice of Eastern North America, antedated by americanus of Kerr.**—The substitution of little-known names for those that have been long in current use is always greatly to be deplored, but when under the strict rules of nomenclature the necessity arises, it seems better to make the change without further delay, since, sooner or later, the issue will be forced by some stickler for rigid adherence to nomenclatural law, and the

temporary postponement only aggravates the inconvenience when in time the change comes to be made. The particular point here at issue was raised by Dr. Coues in 1875* and 1877,† but owing to his inability to verify a needed reference he (unavoidably perhaps) allowed an obvious case of infringement of the law of priority to pass uncorrected. Had the change been made then the new name would long since have become current and familiar.

As is well known, Robert Kerr published in 1792 an English version of Gmelin's Linnæus, with many additions, under the title, "The Animal Kingdom, or Zoological System of the Celebrated Sir Charles Linnæus;—Class I, Mammalia: containing a complete Systematic Description, Arrangement, and Nomenclature, of all the known Species and Varieties of the Mammalia, or Animals which give suck to their Young; being a translation of that part of the Systema Naturæ, as lately published, with great improvements, by Professor Gmelin of Goettingen. Together with Numerous Additions from more recent Zoological writers, and Illustrated with Copper plates." The work is very rare in libraries, abroad apparently as well as in this country. The only copy I have seen is in the Library of the Boston Society of Natural History.‡ It is an important work, although a compilation, since a number of systematic names originated here, though in many cases attributed to Shaw and Turton, and in others wholly overlooked by subsequent writers. It is also interesting to note that Kerr adopted a system of trinomial nomenclature for the designation of varieties similar to that now so currently in use.

Pennant, in his "Synopsis of Quadrupeds" published in 1771, gave an excellent description of our White-footed Mouse, apparently from a New York specimen in the museum of Sir Ashton Lever, which description is the basis of Kerr's *Mus agrarius americanus*, cited by Coues in 1874, 1875, and 1877, in his well-known papers on the North American Muridæ, he adopting the name *americanus* for the species in 1875, and receding from this adoption in 1877, pending final verification of the Kerr reference, taken by him at second hand.

* Rep. Zoöl. of Wheeler's Exp. & Surv. West of 100th Merid., V, 1875, p. 102.

† Mon. N. Am. Roden., 1877, p. 51.

‡ *Cf.* Oldfield Thomas, Ann. & Mag. Nat. Hist., 5th Ser., IV, 1879, pp. 396–397; Allen, Hist. N. Am. Pinnipeds, 1880, p. 344, and Bull. U. S. Geol. Survey, VI, No. 3, 1882, p. 481.

Pennant under "No. 230, FIELD [RAT]." gives: "*a.* AMERICAN," which he describes as follows: "R[AT]. with very long whiskers, some white, others black: ears large, naked and open: from the head to the tail, along the middle of the back, a broad dark stripe, ferruginous and dusky: the cheeks, space beneath the ears, and sides, quite to the tail, orange-colored: underside, from nose to tail, of a snowy whiteness: feet white: hind legs longer than those of the *European* kind: tail dusky above, whitish beneath. *New York.*"* This description is repeated in his "History of Quadrupeds" (1781), and also in his "Arctic Zoölogy" (I, 1784, p. 131), here slightly changed verbally and with the addition of "Length about four and a half inches, of tail four inches;" and, "Inhabits *Hudson's Bay* and *New York.*"

Hence the pertinency of Kerr's name *americanus* to what has of late been known as *Hesperomys* (*Vesperimus*) *leucopus* is beyond question.

The name *leucopus* dates from Rafinesque, 1818, who describes a *Musculus leucopus*, giving no further habitat than is implied in the general title of his paper, which purports to describe, among other things, nine new species of Bats and ten new species of "Wild Rats," met with by him in "a journey through the Western Region of the United States," namely, the lower Ohio Valley and the Pine Barrens of Kentucky. None of these can be positively identified, though two or three may be guessed at with some degree of certainty, among which is his *Musculus leucopus*, which he thus describes:

"*Musculus leucopus*, R. (White-feet Mouse.) Body brownish, fallow above, white beneath, head fallow, ears large, blackish, tail as long as the body, pale brown above, gray beneath, legs and feet white. Length 5 inches."

To complete the record I append the following transcript from Kerr, as above cited, showing the basis of *Mus agrarius americanus*:

"473. β. AMERICAN RUSTIC MOUSE.—*Mus agrarius americanus.*

"Has a broad stripe along the middle of the back of a mixed dusky and ferruginous colour; the cheeks, space beneath the ears, and sides, are orange coloured; and all the under parts of the body, the legs and feet, are pure white. Penn. Hist. of Quad. n. 302. β.

* Synopsis of Quadrupeds, 1771, p. 303.

"Inhabits New-York.—The ears are large, open, and naked; the whiskers very long, some of the hairs being white and others black; the hinder legs are somewhat longer than the fore; the tail is dusky above, and whitish beneath."

The name and principal synonomy of this species will hence stand as follows:

## **Vesperimus americanus** (*Kerr*).

(WHITE-FOOTED MOUSE.)

*American Field Rat*, PENNANT, Synopsis Quad., 1771, p. 303 (New York); Hist. Quad., 3d ed., II, 1793, p. 185; Arct. Zoöl., I, 1784, p. 131.

*Mus agrarius americanus* KERR, An. King., I, 1792, p. 231 (based on Pennant, as above).

*Hesperomys* (*Vesperimus*) *americanus* COUES & YARROW, Expl. & Surv. W. 100th Merid., V, 1875, p. 102.

? *Musculus leucopus* RAFINESQUE, Am. Month. Mag., III, 1818, p. 446.

*Mus leucopus* RICHARDSON, Faun. Bor.-Am., I, 1829, p. 142 (in part).—DEKAY, Nat. Hist. New York, Zoöl., I, 1842, p. 82.

*Hesperomys leucopus* LECONTE, Proc. Acad. Nat. Sci. Phila., 1853, p. 412. Also of Baird, Coues, and most subsequent authors.

*Mus agrarius* GODMAN, Am. Nat. Hist., II, 1826, p. 88 (not of Gmelin; description apparently copied from Pennant).

*Arvicola emmonsi* DEKAY, Rep. Quad. Mass., 1840, p. 61.

## **Vesperimus nudipes** *Allen.*

Since describing this large Costa Rican species,* from a single adult female preserved in spirits, I have received from Mr. George K. Cherrie a skin, with the skull, of a second specimen apparently referable to the same species. It is a somewhat smaller and also a much younger animal, but I perceive no differences that warrant its specific separation. The teeth are entirely unworn, instead of well-worn, as in the former specimen, and the general condition of the skull is that of a nearly full-grown adult. In the softness of the pelage and in coloration the two specimens are nearly identical, and the original diagnosis requires qualification in only the following particulars: The feet are not entirely naked as in the adult, but the upper surface is clothed with very short glistening gray hairs, barely concealing the skin, while the lower part of the tibia and upper portion of the metatarsus is similarly clothed with very short dusky fur. The "flesh-color" ascribed to the feet in the original description proves due to immersion in spirits, and to the nakedness of these parts in

* This Bulletin, III, No. 2, p. 213 (author's separates issued April 17, 1891).

the type. The tail is wholly naked and finely annulated, as originally described. The "pale chestnut" or fawn-colored breast patch is a conspicuous feature.

The skull is about two-tenths of an inch shorter in total length, and proportionately narrower, with the dimensions of particular parts correspondingly less, except the length of the molar series, which is barely less than in the adult.

This specimen is labeled "near San José, Costa Rica, Dec., 1890, George K. Cherrie."

## **Vesperimus difficilis,** sp. nov.

Similar in size and proportions to *V. megalotis*, as regards relative length of body and tail, but with much smaller ears, much larger hind feet, and very different coloration.

Above dusky brown, faintly washed with pale cinnamon fulvous, with a broad band of strong buffy cinnamon on the sides of the body, paler and more ashy on the nape and shoulders; beneath white at the surface with the basal two-thirds of the fur deep plumbeous; a narrow eye-ring and a spot at the base of the whiskers blackish; tail sharply bicolor, blackish above, white below, well-haired and penicillate. Fore feet dull whitish to above the wrist; hind feet similar, with the extreme base of the metatarsus dusky, like the legs. Ears very large, dusky, foliaceous, nearly naked (very fine short hairs may be seen with a lens), very faintly edged with gray; a large inner lobe at the base. Soles naked as far as the last tubercle and on the inner edge nearly to the heel; outer toe of pes very short. Whiskers very long, mixed black and white.

*Measurements* (approximate from skin): Total length, 201 mm.; head and body, 92; tail vertebræ, 103, pencil at tip, 6; hind foot, 25.4; ear from notch, 21.3.

Skull: Total length, 29.7; basal length, 24.1; greatest (zygomatic) breadth, 14.7; length of lower jaw (condyle to tip of incisor), 18.3; height (angle to coronoid process), 6.6.

Type, No. $\frac{1994}{1263}$, ♂ ad., Sierra de Valparaiso, Zacatecas, Mexico, July 27, 1889, Dr. Audley C. Buller.

This species belongs to the large-sized, big-eared group of North American Vesper Mice, finding its nearest ally apparently in *V. megalotis* Merriam,* from Arizona, from which it differs in having much smaller ears, much larger hind feet, and much darker coloration, the dorsal surface being suffused faintly with a dull tint of reddish brown instead of being strongly suffused with

* North Am. Fauna, No. 3, Sept., 1890, p. 64.—I am indebted to Dr. Merriam for the loan of one of his original specimens of *V. megalotis* (No. $\frac{17922}{24833}$, ♀ ad.).

yellowish brown. The skull indicates a somewhat larger animal, with relatively stronger dentition. The skull is broader in proportion to its length; the palatal region is conspicuously broader, the lower jaw and the whole dental armature much heavier.

Compared with *V. melanophrys* Coues,* from Southern Mexico, it is a much smaller animal, the feet being fully one-fifth smaller, and very different in coloration, while the skull differs notably in many characters.† While much smaller, the tooth row is longer and the individual teeth of the molar series are much larger; the rostral portion of the skull is narrower and weaker, and the maxillary branch of the zygomatic arch much more slender. In short, *V. difficilis* is apparently beyond question entirely distinct from either *V. megalotis* or *V. melanophrys*, though somewhat intermediate between them in certain features, and apparently much nearer the former than the latter.‡

## **Vesperimus nasutus,** sp. nov.

Ears large, foliaceous, nearly naked; feet long and slender; tail sharply bicolor and well clothed; soles naked to behind the last tubercle, probably wholly naked in summer.

Above dusky with a strong suffusion of pale grayish buff, which on the sides deepens into yellowish buff, forming a strongly defined lateral band extending from the base of the whiskers to the base of the tail; beneath clear white, the basal half of the fur blackish plumbeous. A narrow eye-ring and a spot at the base of the whiskers blackish; feet white tinged with flesh-color; the dusky color of the hind leg extends to the upper portion of the metatarsus; tail blackish above, white below.

*Measurements* (as taken by the collector before skinning): Total length, 190 mm.; head and body, 85.7; tail, 104.7; ear, 69. From skin: Total length, 193.3; head and body, 87.9; tail vertebræ, 95.2; tail to end of hairs, 105.4; hind foot, 22.4; ear from notch, 19.6.

Skull: Total length ——? (imperfect); basal length (condyle to incisors), 22.4; greatest width, 14.5; length of nasals, 11.9; length of lower jaw, 17.8; height (angle to coronoid process), 64.

Type, No. $\frac{2397}{2670}$, ♂ ad., Estes Park, Larimer Co., Colorado, Jan. 20, 1891.

* Mon. North Am. Roden., 1877, p. 102.—I am indebted to Mr. True for the loan of the type, No. 10,183, ♀ ad., Sta. Efigenia, Tehuantepec, July 11, 1871.

† From a hasty comparison of the *skin* of the single specimen on which *V. difficilis* is now based with the *skin* of the type of *V. melanophrys* Coues I referred it (this Bulletin, II, p. 187) with some misgivings to that species. A recent re-examination and careful comparison of both the skins and skulls of the two forms, with much additional material bearing on the problem, shows them to be very different; and my former repugnance to describing a new form of Vesper Mouse from a single specimen yields to the new evidence a more careful examination discloses.

‡ For further remarks on the character and affinities of *V. melanophrys*, see a paper soon to appear in Proc. U. S. Nat. Mus., Vol. XIV, 1891.

This species is allied to *V. megalotis* (Merr.) and *V. truei* (Shuf.),* though smaller than either. It differs from the former almost inappreciably in cranial characters and dentition, except that the rostral portion of the skull is stouter, and the whole skull is shorter and broader. As regards external characters, the ears are smaller, the general coloration is grayer and paler, with less of the buffy suffusion. From *V. truei* it differs in the possession of a longer and slenderer hind foot, much longer and less hairy tail, and very greatly in its much paler and grayer coloration.

*V. truei*, *V. megalotis*, *V. difficilis*, and *V. nasutus* form a group of rather nearly allied forms, occupying the great Rocky Mountain plateau region from northern Colorado to central Mexico, and represent the much larger and darker *V. californicus* group of southern California. Apparently no specimens of any of these interior forms had been seen by mammalogists till *V. truei* was described by Dr. Shufeldt in 1885. Three of them are at present known from single specimens, from widely separated localities. While as now known they present differences not to be accounted for by either individual or seasonal variation, it seems probable that the examination of more abundant material, including specimens from many intermediate localities, may eventually show these forms to be merely geographic phases of a widely distributed species.

## **Vesperimus mearnsii,** sp. nov.

Above dusky grayish brown, with a faint suffusion of fawn, the latter becoming strongest on the sides of the body, and varying in intensity and breadth in different specimens, but rarely forming a well-defined lateral stripe, even at the border of the pure white of the lower surface. Whole top and sides of the head, including eye-region, uniform with the rest of the dorsal surface. Below pure white, with the extreme base of the fur grayish plumbeous. Middle of the breast often marked with a spot of clear pale fawn, varying in size in different specimens from a slight trace to a large diamond-shaped spot three-fourths of an inch long by half an inch in width. (Four out of eight specimens have the fawn-colored breast spot, while the other four show no trace of it.) Ears large, dusky, naked except the outer basal third, and very narrowly edged with white. Tail dusky gray above, rather lighter below, and hence only very indistinctly bicolor, very sparsely haired (generally the annulations are distinctly visible),

* Proc. U. S. Nat. Mus., 1885, p. 407, pl. xxi.—I am indebted to Mr. True for the loan of the type (No. $\frac{14954}{35108}$, ♂ ad., Fort Wingate, N. Mex., Mch. 14, 1885), for examination in the present connection.

and very scantily tufted at the end. Feet soiled grayish white; soles hairy behind the last tubercle.

*Measurements* (as made by the collector before skinning—average of 5 specimens, 2 ad. males and 3 ad. females): Total length, 178.6 mm.; head and body, 98.6; tail, 80; ear, 13.7; hind foot (from skin), 20.8; ear from notch (from skin), 15.2.

Skull: Total length, 25.4; basal length (cond. to incis.), 21.6; greatest width, 13.2; nasals, 10.7; lower jaw (incis. to condyle), 15.7; height at coronoid, 6.6.

Type, No. $\frac{3400}{2673}$, ♀ ad., Brownsville, Texas, Feb. 4, 1891.

*Vesperimus mearnsii* is based on seven specimens collected at Brownsville, Texas, Jan. 27 to March 11, 1891. An exactly similar specimen (No. 2367, Coll. Am. Mus., adult male) was collected at Fort Verde, Arizona, Oct. 15, 1885, by Dr. E. A. Mearns. It is rather more thinly haired than the Brownsville winter specimens, not having fully acquired the winter coat. It has a large fawn-colored patch on the breast, but the lower surface is more or less grayish, with the pure white of the winter coat appearing in irregular patches.* In other respects it is exactly like an average winter specimen from Brownsville, Texas. The species has thus apparently a rather extended range, although I have as yet met with no specimens from any point except the two localities above named.

It differs strikingly in coloration and general appearance from any of the numerous forms of the *V. leucopus* group thus far described, it being very different from either *sonoriensis* or *texanus*, of which I have before me good series of each. It seems to be the exact counterpart in the genus *Vesperimus* of Baird's *Neotoma micropus* in the genus *Neotoma*; both are apparently abundant in the immediate vicinity of Brownsville. It is a little larger than *V. l. texanus*, being fully as large, if not larger, than restricted *sonoriensis*, which seems to range into southwestern Texas and south into Mexico.

*V. mearnsii* is readily distinguishable from either of these, and indeed from any other known form, by its peculiar dusky grayish-brown coloration. The brown chest-spot occurs, among North American species, so far as known to me, only in the big-eared *californicus* and *megalotis* groups, and then only rarely.

* The back of the label bears the following, in Dr. Mearns's handwriting: "A very remarkable beast, having a brown spot on breast, and somewhat resembling *Mus musculus*. Caught in Post Hospital. E. A. M."

In cranial characters there is nothing very tangible to distinguish it from the other small forms of *Vesperimus*.

## Vesperimus americanus sonoriensis (*Leconte*).

*Hesperomys sonoriensis* LECONTE, Proc. Acad. Nat. Sci. Phila., VI, 1852–3, p. 413 (Oct., 1853).—BAIRD, Mam. N. Am., 1857, p. 474 (in part only); U. S. & Mex. Bound. Surv., II, pt. ii, 1859, p. 43 (in part).

*Hesperomys* (*Vesperimus*) *leucopus sonoriensis* COUES, Proc. Acad. Nat. Sci. Phila., 1874, p. 179 (in part only).

*Hesperomys leucopus sonoriensis* COUES, Mon. N. Am. Roden., 1877, p. 79 (in part only).—MERRIAM, N. Am. Fauna, No. 3, Sept., 1890, p. 66.

*Hesperomys leucopus deserticolus* MEARNS, Bull. Am. Mus. Nat. Hist., II, No. 4, pp. 185, 187, Feb., 1890.

*Hesperomys sonoriensis* was described by Leconte in October, 1853, from a single immature example collected by the U. S. and Mexican Boundary Commission at Santa Cruz, State of Sonora, Mexico, a point only a few miles south of the present Arizona boundary. This specimen (No. 146, U. S. Nat. Mus.) is now before me, having been kindly loaned me by the authorities of the U. S. National Museum for examination. This was originally the sole basis for the species. As stated by Dr. Coues (N. Am. Roden., p. 79) "it is a young animal about three-fourths grown, in gray pelage identical with that of the same age of *leucopus*. While nothing, therefore, can be predicated upon its absolute size or its color, it may be known at a glance from ordinary *leucopus* by the shortness of the tail."

Professor Baird, in 1857 (l. c.), referred specimens to *sonoriensis* from El Paso, Texas, Fort Thorne, New Mexico, and from various points in Colorado, Wyoming, the Dakotas, and Montana, these specimens, as compared with '*leucopus*,' agreeing in pallid coloration and short tails. Some of these specimens are now before me, among them one of the Fort Thorne specimens (now No. 5566, Mus. Comp. Zoöl.=543, U. S. Nat. Mus.), which series Baird practically took as representing Leconte's *H. sonoriensis* (*cf.* N. Am. Mam., p. 475); his own diagnosis of *H. sonoriensis* was based on specimens from "the Upper Missouri" (*cf.*, *ibid.*, p. 474, last paragraph). On a preceding page (p. 462), under *H. leucopus*, he apparently referred to these specimens under the designation "*Hesperomys sonoriensis*, var. *nebracensis*." But this "var. *nebracensis*" is not characterized, nor does the name appear

to occur elsewhere in the work, not even in the index. *H. sonoriensis*, as provisionally recognized by Professor Baird, is a large, stout, short-tailed, pale form, ranging from "Sonora along the Rocky Mountains and Black Hills to the Saskatchewan, or even further north," but with the intimation that the Sonoran and New Mexican animals might be different from those from the Upper Missouri and northward.

*Hesperomys* (*Vesperimus*) *leucopus sonoriensis* of Coues is practically the *H. sonoriensis* of Baird. The name *sonoriensis*, however, when applied in this wide sense, evidently covers, in the light of material now available for study, a group of forms, more or less closely allied, and in all probability intergrading where their habitats adjoin, yet in the main characterizing distinct physiographic regions. The form found, for example, in eastern Montana is quite different from the form inhabiting the desert lands of Sonora and Arizona. A still different form inhabits the wooded mountain district of Arizona, and another still occupies southern and eastern Texas. It hence becomes important to establish and restrict, if possible, the various names already applied to the different forms of this wide-spread group of short-tailed mice of the *sonoriensis* type.

An attempt to do this was recently made by Dr. Mearns (this Bulletin, II, pp. 284–287, Feb., 1890), but unfortunately with but partially satisfactory results. While discriminating with creditable precision the several forms treated, too little attention seems to have been paid to the literature of the subject, resulting in what seems to me a misapplication of some of the earlier names. His *sonoriensis*, for example, can not well be the *sonoriensis* of Leconte, or even of Baird and Coues, at least in a strict sense, the *sonoriensis* of these writers being a pallid desert form, while *sonoriensis* of Mearns is the much larger, darker-colored mountain form of the San Francisco Mountain wooded region, recently described by Dr. Merriam* as *Hesperomys leucopus rufinus*, the true *sonoriensis* being renamed by Dr. Mearns (l. c.) *Hesperomys leucopus deserticolus*. The two forms are very different (Dr. Mearns and Dr. Merriam have each, independently and on the basis of wholly different material, separated them); and it is

* N. Am. Fauna, No. 3, p. 65.

entirely against the probabilities of the case that the mountain form was the form obtained on the plains about Santa Cruz by the naturalists of the Boundary Commission and named *sonoriensis* by Dr. Leconte. Besides, I am informed by Dr. Merriam that prior to his determination of what *sonoriensis* should be he had taken the pains to have specimens collected from all about the type locality of the species. Besides, his determination of *sonoriensis* agrees with what has been currently accepted as *sonoriensis*.

It may be added in this connection that I have before me authentic specimens of Merriam's *H. l. rufinus* and Mearns's type (and other examples) of his *H. l. sonoriensis*, and that they are strictly identical; also the type of Mearns's *H. l. deserticolus* and an authentic specimen (No. $\frac{17931}{24842}$, U. S. Nat. Mus.) of Merriam's *H. l. sonoriensis*, which are also identical. Also much other coroborative material bearing on the general question.

## Vesperimus americanus nebracensis (*Mearns*).

*Hesperomys leucopus nebracensis* MEARNS, Bull. Am. Mus. Nat. Hist., II, No. 4, p. 285, Feb., 1890.
*Hesperomys sonoriensis* BAIRD, Mam. N. Am., 1857, p. 474 (in part).

In the American Museum Collection are two series of White-footed Mice, consisting each of eight specimens, strictly comparable as regards season, the one from central Montana, the other from the extreme northwestern corner of the Indian Territory.* On the first was based Dr. Mearns's *Hesperomys leucopus nebracensis*; on the other, his *Hesperomys leucopus texanus*. Mearns's *H. l. nebracensis* is evidently what Baird at one time intended to name *nebracensis*, but which he failed to formally designate and describe. Hence the name *nebracensis* as used by Baird in this connection is a *nomen nudum*, and really dates from Mearns's use of it in 1890, as above. This form is a member of the *sonoriensis* group, and apparently a strongly marked one, at least as regards coloration.

## Vesperimus americanus texanus (*Woodhouse*).

*Hesperomys texana* WOODHOUSE, Proc. Acad. Nat. Sci., Phila., Feb., 1853, p. 242; Sitgreaves's Rep. Expl. Zuñi and Colorado Rivers, 1854, p. 48, pl. ii.

* Both were collected by Museum Expeditions—the first by Elliot and Richardson in October, 1887, the other by Richardson and Rowley in October, 1889.

*Hesperomys texanus* BAIRD, Mam. N. Am., 1857, p. 464 (at least in part).
*Hesperomys leucopus texanus* MEARNS, Bull. Am. Mus. Nat. Hist., II, No. 4, p. 285, Feb., 1890.

As already indicated, *H. l. texanus* of Mearns is based on a series of specimens collected in October in the extreme western part of the Indian Territory adjoining New Mexico. While very different from the Montana series, they are not so easily distinguished from September specimens of true *sonoriensis* from Arizona. They are perhaps a little more strongly colored and more mixed with black on the median line of the back.

*Hesperomys texanus* was described by Woodhouse in 1853 from a specimen (without date), from "near El Paso," on the Rio Grande, Texas. Baird, in 1857, referred to it an alcoholic example from Fort Bliss, New Mexico, other specimens from near El Paso (El Paso and Waco Tanks, N. M.), and from the lower Rio Grande (Brownsville, Texas, and Charco Escondido, Mex.). Coues, in 1887, enumerates practically the same set of specimens, but declines to recognize *texanus* as distinguishable from ordinary *leucopus*. The type was a skin preserved in alcohol, which, Mr. True kindly informs me, is either not now extant, or has been misplaced in the collection and cannot be found. He has, however, kindly sent me another Woodhouse specimen (No. 4748, Nat. Mus.), a skin, labeled by Prof. Baird "*Hesperomys texana.* W. Texas, Dr. Woodhouse." This agrees exactly with the type of Dr. Mearns's description of his *Hesperomys leucopus texanus* (l. c.). Presumably the Woodhouse specimen, though not the type, correctly represents the *H. texana* of Woodhouse, as it certainly does Baird's *H. texanus*, and thus practically establishes the correctness of Dr. Mearns's identification. Doubtless if the type were at hand it would be of little use, after nearly forty years immersion in alcohol.

### Vesperimus americanus rufinus (*Merriam*).

*Hesperomys leucopus rufinus* MERRIAM, N. Am. Fauna, No. 3, p. 65, Sept., 1890.

*Hesperomys leucopus sonoriensis* MEARNS, Bull. Am. Mus. Nat. Hist., II, No. 4, Feb., 1890, pp. 285, 287 (not *H. sonoriensis* Leconte, Baird, and previous authors generally).

As already said, the form of *V. americanus* found in the wooded San Francisco mountain region of Arizona is very different from

the form of the adjoining deserts. Dr. Merriam compares it with *americanus* ('*leucopus*') proper of the Adirondack region of New York, which it strikingly resembles in color, while differing strongly in other features. I have had the opportunity of placing side by side specimens from the two regions and noting their close similarity in coloration. I also find that specimens of *rufinus* when placed in a series of winter specimens of *Vesperimus americanus gossypinus* from Florida present no differences in coloration sufficient to attract the eye, except in the sharply bicolored tail of the former as compared with the nearly unicolor tail of the latter.

These facts serve to emphasize the statement already made (antea, p. 265), that specimens of our smaller mammals, from very remote localities, may occasionally be 'matched' with great closeness, as regards coloration, while really very different forms, separated by wide areas where neither of the two forms compared occur. If conditions of pelage and coloration due to age and season be ignored, as well as important geographical considerations, it would be easy to claim intergradation where in reality not only none exists, but where it would be physically impossible.

Similarity of environment at localities widely separated, and physiographically isolated from each other, not unfrequently results in superficial features of resemblance, as notably in coloration, among closely-allied forms, of which the *V. americanus* group presents a striking illustration.

Dr. Coues, in 1877, in summarizing the results of his careful examination of several hundred specimens of what he considered true *Vesperimus* '*leucopus*' from eastern North America,—Labrador to the Carolinas and west to Kansas,—said: "In the matter of color, there is positively nothing in this whole series that we cannot exactly match among Massachusetts skins [of which he had a series of about 80 from Middleboro, Mass., alone]. And yet it is curious to observe that almost every considerable geographical area within the limits represented in the table [accompanying tabulated list of specimens] produces a slight strain or breed of its white-footed mice—some difference of color indescribable in words, but which strikes the eye that is very

familiar with the subject. The Nova Scotian animal and the Virginian, the Illinois and the Kansas, are always distinguishable. We venture to assert that we can distinguish in North America about *twenty kinds of Hesperomys leucopus* upon characters at least as constant, reliable, and tangible as those hitherto held to define the greater part of the 'species' that have been in vogue of late years."

When it is recalled that Dr. Coues's material was poor in quality as compared with that now available, and that he rarely had large series of specimens from distant regions which were strictly comparable, it speaks well for his discrimination that he was able, in a certain sense, to foreshadow what will be doubtless the final outcome of our studies of the group, based on material sufficient to disclose the real state of affairs in this wide spread, protean type, ranging as it does from ocean to ocean, and from the Arctic Regions to within the tropics, and thus exposed to the widest possible range in conditions of environment, as regards both temperature and humidity, and the resulting modifications of the fauna and flora of such widely diverse portions of the North American continent. But the time has not yet come for a satisfactory revision of the group, to attempt which at least 20,000 specimens are requisite, collected so as to fully represent the seasonal phases of pelage obtaining at hundreds of more or less widely separated localities. With the great accession of material since Dr. Coues wrote on the group, present workers can see more clearly than it was possible for him then to perceive, that the assertion he ventured to make has a very tangible basis.

### **Sciurus hudsonius californicus** *Allen.*

*Sciurus hudsonius californicus* ALLEN, Bull. Am. Mus. Nat. Hist., III, No. 1, 1890, p. 165.

Respecting the range of this subspecies, based on a series of eight specimens from Placer County, Cal., I stated (l. c.) that its habitat would probably be found to extend over a considerable area in California. I have since had opportunity of seeing specimens in the U. S. National Museum and in the collection of Dr. C. Hart Merriam from various points northward to Lassen, Shasta, and Siskiyou Counties, showing it to be the characteristic

form of the *S. hudsonius* group over a large part of Central and Northern California.

### **Lepus cinerascens** *Allen.*

This species was recently described (this Bulletin, Vol. III, p. 159, Oct., 1890) from a single specimen, collected at San Fernando, Los Angeles County, California, March 22, 1890, by Mr. E. C. Thurber. The Museum has recently received, through Mr. C. K. Worthen, eight additional specimens, as follows: Two adult males, San Diego Co., Cal., June 16 and 26, 1889, and another male, Dulzura, July 30, 1890. Also, same locality, adult male and female, Jan. 2 and Jan. 30; adult male, Feb. 6; and two adult females, March 10 and March 16, 1891. The January and February specimens are a little darker than the type, taken March 22, with which the other two March specimens nearly agree. The three summer specimens differ from the type in the pelage being shorter and finer, and the coloration slightly more fulvous, *i. e.*, less bleached. The differences, however, are too slight to require more particular mention, the validity of the characters originally given for the species being satisfactorily confirmed.

The collector's measurements from the fresh specimens average as follows: Five males, head and body, 12.03 in.; tail, 1.44; ear, 3.10. Three females, head and body, 12.63 in.; tail, 1.50; ear, 3.15.

### **Spilogale indianola** *Merriam.*

*Spilogale indianola* MERRIAM, N. Am. Fauna, No. 4, Oct., 1890, p. 10.
*Spilogale indianola?* ALLEN, Bull. Am. Mus. Nat. Hist., III, No. 2, 1891, p. 219 (April, 1891).

*Spilogale indianola* was founded on two skulls from Indianola, Matagorda Bay, Texas, collected in 1851 by J. H. Clarke. As the skins were not preserved Dr. Merriam was unable to give any account of the external characters of the animal. A few weeks since I provisionally referred (antea, p. 219) to it a skin from Tamaulipas, Mexico (exact locality not known), of which a full description was given. The skull, unfortunately, was too imperfect to afford any basis for comparison with the type. Since this account was published, the Museum has received a skin (with

the skull) from Corpus Christi, Texas, collected by Mr. Frank M. Chapman, April 5, 1891. This specimen, an adult male, agrees almost exactly in coloration with the Tamaulipas specimen. The chief differences consist in the white markings being even more restricted than in the Tamaulipas example, the white patch in front of the ear being reduced to an obscure tuft of white hairs, discoverable only on close examination. There is also less white at the base of the tail (merely a small tuft of white hairs on either side of the median line, separated by a broad area of black), and the white markings on the thighs and lower back are more restricted.

Mr. Chapman's measurements of the Corpus Christi specimen, taken before skinning, are as follows : Total length to end of tail hairs, 650 mm. ; to end of tail vertebræ, 560 ; head and body, 342 ; tail to end of vertebræ, 218 ; to end of hairs, 410 ; hind foot, 46.

The skull measures as follows : Total length (condyle to front of premaxillary), 53.8 ; greatest zygomatic breadth, 32.3 ; greatest mastoid breadth, 29.2 ; least interorbital breadth, 14.2 ; length of lower jaw (front of incisors to condyle), 34.3 ; height at coronoid process, 17.3.

Through the kindness of Mr. F. W. True, I have before me the type (skull, No. 1621, Nat. Mus.) of *S. indianola* for comparison with the Corpus Christi specimen. The two skulls are not quite comparable as regards age, the Indianola specimen being considerably younger (a 'young adult') than the Corpus Christi example, the latter having well-developed occipital and sagittal crests, while in the former the occipital crest has begun to develop while the sagittal is not yet indicated. In the Corpus Christi specimen the occipital crest is extended as a ridge along the lateral border of the mastoids—a feature lacking in the Indianola skull, and evidently due to the greater age of the Corpus Christi skull. The Indianola skull is also smaller, and though unmarked for sex is doubtless that of a 'young adult' female, while the Corpus Christi skull is that of an old adult male. With these facts in mind, the two skulls may be considered as exact counterparts, the smaller size being attributable to sex and the other slight differences to difference in age.

In size and coloration *S. indianola* appears to differ little from *S. ringens* Merriam (judging from the description of the latter), with which it naturally find its nearest relationship.

## **Felis eyra** *Desm.*

Among the numerous specimens of mammals from Brownsville, Texas, recently received through Mr. C. K. Worthen, is a fine example of *Felis eyra*, labeled "♂, Rio Grande, Cameron Co., Texas, Feb. 5, 1889." On questioning the correctness of the alleged locality I am assured by Mr. Worthen that his collector states emphatically that the specimen was taken at the assigned locality; the collector adds that while the species is now rare there it is still taken occasionally. So far as known to me this is the first authentic record of the capture of *Felis eyra* north of the Rio Grande.

ARTICLE XXI.—*On the Color-Pattern of the Upper Tail-Coverts in Colaptes auratus.* By FRANK M. CHAPMAN.

Several years ago my attention was attracted by the wide range of variation shown in the color-pattern or *pictura* of the upper tail-coverts of *Colaptes auratus.* Until the present time material to study this variation has not been available. Dr. Allen now places at my disposal the fine series of *Colaptes* which, through the assistance of fellow-naturalists, he has brought together for use in another connection. The variation in question occurs in all of the upper tail-coverts, and its nature may be understood by reference to the accompanying plate (p. 314) in which are figured the middle coverts alone. Figs. 1 and 2 represent the first stages in a series of patterns which terminate in Fig. 15. With few exceptions birds in first plumage agree with Figs. 1 or 2, which represent the amount of variation at one stage. Subsequent changes are apparently accomplished by the moult, and one moult may carry a bird through one or all of the stages figured. For example: No. 103,072 of the U. S. Nat. Mus. Collection (Warren Creek, Col., ♀, Dec. 26, F. Ball) has nearly completed its adult plumage, but there remains of the first plumage one of the long upper tail-coverts intermediate in pattern between Figs. 1 and 2, while the corresponding feather of the new plumage agrees very nearly with Fig. 12. Other examples in a similar stage of plumage show, as has been said, that the change from a barred to a longitudinally-marked feather is accomplished by one or more moults. The large proportion, however,—one-third—of adult birds agreeing with Figs. 1 or 2, and the frequency of intermediate phases, indicate a more or less regular advance by successive moults to the final stage. While in transition the smaller and more anterior coverts are as a rule slightly in advance of the ones posterior to them. The longest and most posterior feather, therefore, is the last to be affected, and the final result has not been achieved until this feather agrees with the ones before it; for this reason it has been selected to represent the upper tail-coverts as a whole. The lower tail-coverts pass through a somewhat similar series of changes, which to a certain extent correlate with those presented by the upper tail-coverts.

Individual variation at the same stage of marking is well shown by No. 44,212 of the Am. Mus. Collection (Hoboken, N. J., ♂, Ward) in which the feather at the right side of the tail agrees with Fig. 1, while the corresponding feather on the left side exactly resembles Fig. 2. Asymetry in marking not infrequently occurs, and is excellently illustrated by No. 4961 of Mr. Brewster's Collection (Elmore Co., Ala., ♂ ad.). In this specimen the feather at the right of the tail agrees with Fig. 4, while that at the left side is intermediate between Figs. 10 and 11.

All these changes have no evident connection with sex or locality, and apparently depend on age alone. If we attempt to determine their significance we must examine the pattern of the same parts in other members of the genus. There is, apparently, no doubt that in *auratus* the barred feather is the first in a series of changes which at present terminate in the white-edged black feather, and which we may consider an as yet unestablished character.

If we assume that the phases just observed epitomize a transition which is occurring in *auratus*, and if we further assume that *auratus* is the most recent off-shoot of the Neotropical genus *Colaptes*, we should expect the more southern and older species to exhibit only the earlier stages of a color-pattern which in *auratus* has reached its highest degree of development.

Unfortunately very large series of the extralimital species are wanting; so far as my specimens go, however, they seem to support the theory advanced.

*Chrysoptilus* shows its relationships to *Colaptes* in having the tail-coverts similarly barred. Lack of sufficient material, however, will not permit me to determine the extent of variation in the pattern of the tail-coverts of this genus. Twelve of fifteen specimens examined have these feathers barred, the remaining three are very nearly like Fig. 8.

The appended table is designed to illustrate the development of the pattern of the tail-coverts in the species it includes. The accompanying figures were made from specimens of *Colaptes auratus*, but they answer quite as well to represent a given stage in any of the other species except *campestris*. This species resembles Fig. 2, but the bars are finer and more numerous.

In all the species mentioned examples in first plumage have, with few exceptions, the tail-coverts barred.

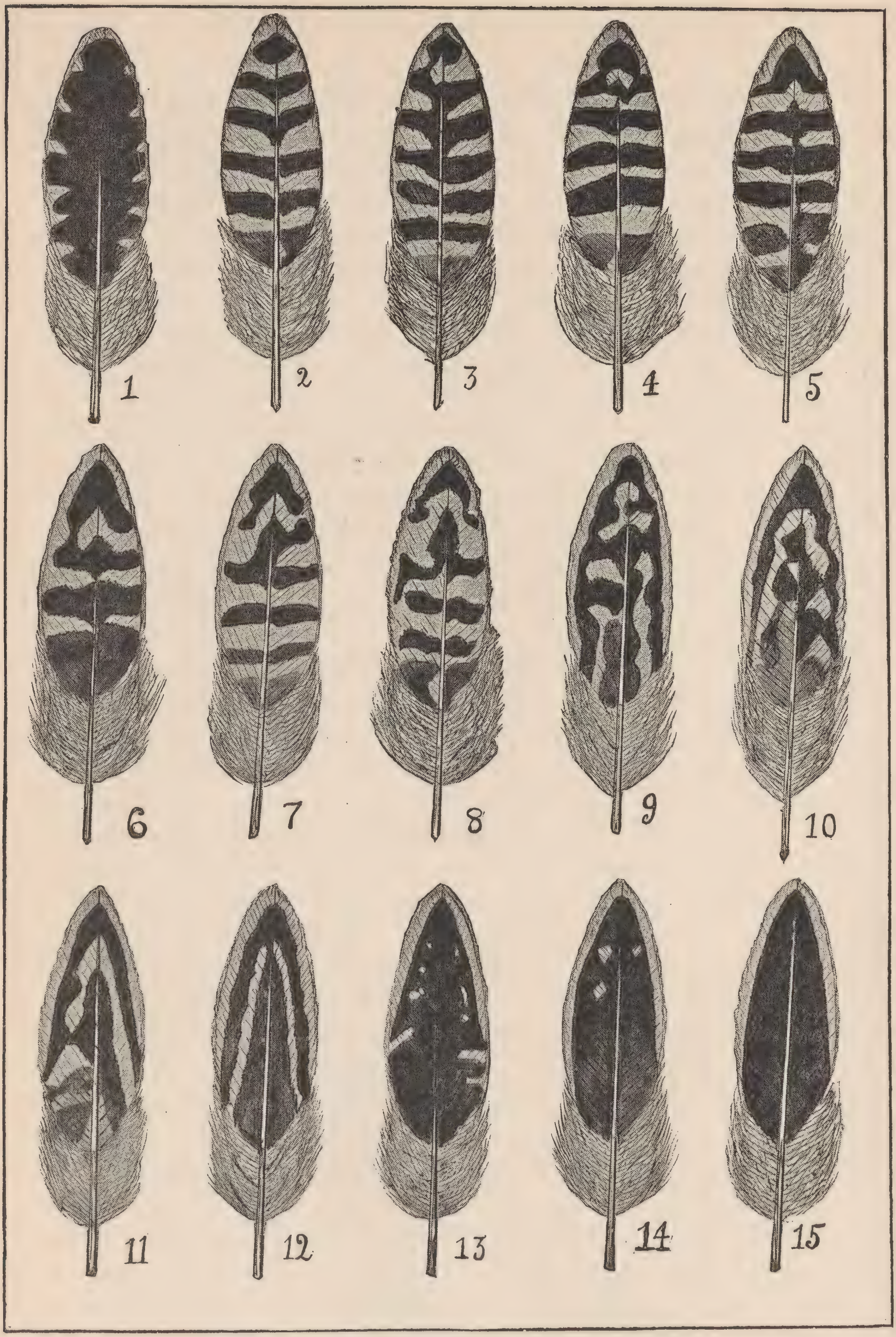
The variations in color-pattern here outlined are not confined to the two genera mentioned, but occur also in the barred feathers of species belonging to other genera. Of these, however, I have not enough specimens to make a comparative study in this connection.

TABLE SHOWING DEVELOPMENT OF THE COLOR-PATTERN IN CERTAIN SPECIES OF *Colaptes*.

| | Auratus. | Cafer. | Saturatior. | Chrysoides. | Mexicanoides. | Campestris. |
|---|---|---|---|---|---|---|
| Number of Specimens | 150 | 156 | 20 | 79 | 10 | 16 |
| Percentage agreeing with Figs. 1–2 | 33 | 43 | 60 | 66 | 70 | 100 |
| " " " 3 | 10 | 11 | 5 | 9 | 20 | |
| " " " 4 | 8 | 5 | .... | 9 | | |
| " " " 5 | 19 | 9 | 5 | 14 | | |
| " " " 6 | 5 | 5 | 5 | | | |
| " " " 7 | 5 | 5 | .... | 1 | | |
| " " " 8 | 5 | 5 | 5 | 5 | 10 | |
| " " " 9 | 1 | 2 | | | | |
| " " " 10 | 3 | 3 | 5 | | | |
| " " " 11 | 2 | 4 | 10 | 1 | | |
| " " " 12 | 6 | 2 | 5 | | | |
| " " " 13 | .07 | | | | | |
| " " " 14 | 07 | | | | | |
| " " " 15 | .07 | | | | | |

## *Explanation of the Figures.*

Fig. 1, No. 44,212, Am. Mus., Hoboken, N. J., ♂, J. F. Ward.
" 2, " 25,798, Am. Mus., Westchester, N. Y., ♂ ad., L. A. Zerega.
" 3, " 51,951, Am. Mus., Fort Snelling, Minn., ♂ ad., E. A. Mearns.
" 4, " 8,307, Wm. Brewster, Ann Arbor, Mich., ♂.
" 5, " 51,946, Am. Mus., Fort Snelling, Minn., ♀ ad., E. A. Mearns.
" 6, " 29,092, Wm. Brewster, Tarpon Springs, Fla., ♂, W. E. D. Scott.
" 7, " 14,359, Wm. Brewster, Grantville, Mass., ♂, Wm. Brewster.
" 8, " 51,943, Am. Mus., Highland Falls, N. Y., ♂, E. A. Mearns.
" 9, " 27,341, Am. Mus., Paterson, N. J., ♂.
" 10, " 12,816, Wm. Brewster, Kankakee Marshes, Ind., ♀, W. S. Perry.
" 11, " 14,088, Wm. Brewster, Mandeville, La., ♂, C. S. Galbraith.
" 12, " 1,238, F. M. Chapman, Pine Island, Fla., ♀, F. M. Chapman.
" 13, " 50,145, Am. Mus., Tarpon Springs, Fla., ♀, W. E. D. Scott.
" 14, " 51,945, Am. Mus., Fort Snelling, Minn., ♂ ad., E. A. Mearns.
" 15, " 84,344, U. S. Nat. Mus., Wabash Co., Ill., ♀ ad., R. Ridgway.




Color-Pattern in Upper Tail-Coverts of *Colaptes auratus.*

(*About four-fifths natural size.*)

ARTICLE XXII.—*On the Birds observed near Corpus Christi, Texas, during parts of March and April, 1891.* By FRANK M. CHAPMAN.

The vicinity of Corpus Christi is by no means ornithologically new ground, Messrs. Sennett, Hancock, and Beckham having published notes based on personal experiences in this field, while an important paper by the last-named author, entitled "Observations on the Birds of Southwestern Texas," has recently appeared in the Proceedings of the United States National Museum (Vol. X, 1887, pp. 633–696). This excellent paper, the last written by Mr. Beckham before his death, contains not only much original matter, but also includes the species not met with by himself but recorded from this region by previous writers. Particular attention is given to the birds of Corpus Christi, and as a result of his own, Sennett's, and Hancock's observations, he gives a list of 139 species as having been found near that town.

The present paper is designed to supplement that portion of Mr. Beckham's which relates to the birds of the vicinity of Corpus Christi. It is based on notes and collections made from March 18 to April 25, 1891. During the first month of this period I resided in the chapparal about one and one-half miles west of the town, and from April 18 to 25, with Mr. J. M. Priour as guide, I camped at various places in the valley of the Nueces River, the most western point reached being only thirty miles from Corpus Christi. This trip was made in the interest of the American Museum of Natural History, and the specimens procured have been added to the collections of that institution.

On visiting this part of Texas the naturalist, whatever be the branch to which he devotes himself, finds his attention at first claimed by the character of the vegetation. There are no forested tracts in the vicinity of Corpus Christi, and but few open prairies, the country being more or less densely covered with the stunted growth known as 'chapparal.' This, however, is of two quite distinct kinds, one of which may be termed scrubby, the other mesquite chapparal. The first is the prevailing growth in the immediate vicinity of the coast; the second is mixed with, or replaces the first farther inland. The scrubby chapparal reaches

an average height of eight to twelve feet, and is largely composed of 'black chapparal,' ebony, catsclaw, and prickly-pear. These are all armed with formidable thorns or spines, which present no slight obstacle to the collector. They grow in impenetrable clumps of varying extent which are separated from one another by winding cow-paths, or glade-like openings where the grass is closely cropped by grazing herds. This was the home of Baird's Wren, the Texan Thrasher, the Texan Cardinal, and the Chapparal Cock, or 'Paisano del Monte,' as the Mexicans call him; here also Mocking-birds and Cardinals (*Cardinalis*) were more abundant than elsewhere.

The mesquite chapparal is formed by more or less open groves of mesquite, and huisache trees which here attain an average height of twelve to eighteen feet. These groves are very beautiful; they are comparatively free from undergrowth, and are carpeted with a rich growth of grass which here, as everywhere, is closely cropped by grazing cattle. In many localities the mesquite and scrub chapparal grow together, the last then forming an undergrowth, and ground of this nature proved the most valuable for collecting.

A third feature in the vegetation, of decided importance from an ornithological standpoint, is the groups of hackberry trees locally known as 'mottes.' These trees grow in clusters of three to ten, and, in size and shape, resemble apple trees of average proportions. Their heavy foliage makes them favorite roosting places for many species of birds, and flocks of migrant warblers visit them in search of insect food.

It is worthy of remark that all the growth just described is said to have largely appeared within the last twenty years, and each year is becoming more dense and steadily encroaching on the small area of open prairie still remaining. The advent of this heavy chapparal dates from the introduction of cattle and conversion of the region into a grazing country. The cattle, it is said, in keeping the grass short have prevented the extensive prairie fires, which were an effectual check to an increase in arborescent vegetation, and in feeding on the mesquite have distributed its seeds unharmed, thus further assisting in promoting the chapparal growth.

The banks of the Nueces River are narrowly skirted with timber to within ten miles of its mouth, when vast marshes intervene which reach to Nueces Bay. At the time of my trip up this river recent heavy rains had caused it to overflow its banks, and the timbered shores were therefore inaccessible. Barred and Great Horned Owls, met with in no other locality, were heard in the distance calling from these woods.

The marshes of Nueces Bay are of great extent. They are bordered by reeds and sedge, are dotted with numerous small ponds, and form excellent resorts for many species of water and marsh birds.

Contrary to the experience of Mr. Beckham I found birds abundant both in species and individuals, and of the 190 odd species observed, at least eighty-five were common.

In the chapparal and prairie openings, and along the roadsides, the birds which more than any others gave character to the avifauna were: Bartram's Sandpipers, Harris's Hawks, Chapparal Cocks, Golden-fronted Woodpeckers, Scissor-tailed Flycatchers, Great-tailed Grackles, Lark Finches, Cardinals (*Cardinalis*), and Mocking-birds, while on moonlight nights the whistled *Kĕr-wēē-you* of the Paraque could be heard on every side. On the waters and shores of Nueces Bay the commoner birds were: Mexican Cormorants, Herring, and Ring-billed Gulls, Brown, and White Pelicans, Shoveller Ducks, Great Blue Herons, Black Skimmers, Avocets, Willets, Greater, and Lesser Yellow-legs, and Wilson's Plovers.

The demand for birds for millinery purposes has sadly thinned the ranks of many species of water birds, especially Terns and Egrets. Royal, Caspian, Forster's and Gull-billed Terns were seen in limited numbers; but only twelve Great White and three Snowy Egrets were observed.

The distinctive birds of the marshes were Spotted Ducks, Pectoral Sandpipers, Nelson's Sharp-tailed and Texan Seaside Finches, and Long-billed and Short-billed Marsh Wrens.

Four species of Swallows were always present in greater or less numbers, and at night the Great-tailed Grackles came to roost in the reeds.

*The Migration.*—When I reached Corpus Christi it was the height of spring. The mesquites had regained their delicate, graceful foliage; the air was fragrant with the rich perfume of huisache blossoms; soon a wealth of many-hued wild flowers appeared on the lawn-like prairie openings; the hedge-rows were brilliant with scarlet lantanas, and the leaves of the cacti (*Opuntia*) were fringed with large yellow flowers.

Purple Martins were already common, and the migration had apparently just commenced. Unfortunately the season proved to be an exceptionably late one, and at the time of my departure the northward movement was far from concluded.

The following list gives the migrants noted, arranged according to the order of their arrival from the South:

| | | |
|---|---|---|
| March | 19. | Elanoides forficatus. |
| " | 19. | Milvulus forficatus. |
| " | 20. | Chætura pelagica. |
| " | 23. | Bartramia longicauda. |
| " | 24. | Dendroica virens. |
| " | 25. | Myiarchus crinitus. |
| " | 27. | Coccyzus americanus. |
| " | 31. | Chelidon erythrogaster. |
| April | 2. | Petrochelidon lunifrons. |
| " | 3. | Vireo olivaceus. |
| " | 3. | Helminthophila peregrina. |
| " | 5. | Icterus spurius. |
| " | 7. | Totanus solitarius. |
| " | 10. | Tyrannus tyrannus. |
| " | 12. | Spiza americana. |
| " | 13. | Actitis macularia. |
| " | 13. | Empidonax minimus. |
| " | 13. | Contopus virens. |
| " | 13. | Icterus galbula. |
| " | 13. | Passerina cyanea. |
| April | 13. | Vireo belli. |
| " | 13. | Icteria virens. |
| " | 16. | Ajaja ajaja. |
| " | 16. | Chordeiles virginianus henryi. |
| " | 16. | Xanthocephalus xanthocephalus. |
| " | 17. | Guiraca cærulea. |
| " | 17. | Helminthophila pinus. |
| " | 17. | Passerina ciris. |
| " | 20. | Piranga rubra. |
| " | 21. | Sylvania mitrata. |
| " | 21. | Geothlypis formosa. |
| " | 22. | Helminthophila celata. |
| " | 22. | Dendroica pensylvanica. |
| " | 22. | " æstiva. |
| " | 23. | Icterus bullocki. |
| " | 23. | Seiurus aurocapillus. |
| " | 24. | Ictinia mississippiensis. |
| " | 25. | Setophaga ruticilla. |

*The Faunal Position of Southwestern Texas.*—The characteristic avifauna of the Lower Rio Grande region in southwestern Texas and northwestern Mexico is composed of two elements. The first is distinctively Sonoran, and includes those species which, ranging across the tableland of Mexico, or occurring on both the eastern and western slopes of the Sierra Madre, are found along the entire Mexican border of the United States.

The second element is composed of Neotropical species which are found in the lowlands of eastern Mexico, or if occurring also in western Mexico, do not there extend their range to our limits. The second element therefore includes species which occur in the United States only in the valley of the Lower Rio Grande.

Possessing few distinctive features, the limits of the Lower Rio Grande fauna, especially to the westward, are not clearly defined. Its southern boundary is the northern limit in eastern Mexico of the true Neotropical region. This, as Salvin and Godman have shown, coincides with the northern limit of forests. To quote from the authors mentioned: "These on the eastern side leave the coast a little north of Tampico and continue in a narrow belt along the eastern flank of the mountains in a northerly direction almost to Monterey" (Ibis, 1889, p. 242).

As we proceed westward and leave the low coast region a change, governed by increase in altitude, occurs. In Mexico this is more or less abrupt, and the rich fauna of the coast is replaced by the poorer fauna of the arid tablelands; in Texas the change is more gradual, and the passage from the Sonoran-Neotropical coast region is marked by the disappearance of the Neotropical element, and the appearance of Sonoran species which do not reach the coast. To the northward along the coast the change is more pronounced, and the Louisianian or Austroriparian fauna may be said to have been fairly reached at the mouth of the Colorado River.

## Remarks on Certain Species Observed.

**Larus franklini.** Franklin's Gull.—A male of this species was taken April 16. A flock of about two hundred was seen April 24 feeding over a flooded meadow on the banks of the Nueces River, about eighteen miles from its mouth. Their cries could be heard at the distance of a mile. Shortly after sunset they gathered in small flocks and flew down the river, probably to roost in the bay below. At dawn on the morning of the 25th, apparently the same gulls had returned to the feeding ground where the birds were seen on the previous day. A scattered flock of fifty were seen at noon on the 25th evidently migrating overland. As they approached the Nueces River they 'closed

ranks,' and in graceful spirals descended to the stream to drink, then arose and resumed their northward journey.

**Anas fulvigula maculosa.** SPOTTED DUCK.—This form of the Black Duck, which was described two years ago by Mr. Sennett from Corpus Christi examples, is a common inhabitant of the marshes about Nueces Bay. It feeds in the small ponds which everywhere dot the marshes, and in notes and actions resembles the Florida species (*Anas fulvigula*).

**Spatula clypeata.** SHOVELLER DUCK.—Abundant. April 25 a flock of about 300 Shoveller Ducks was observed. They were apparently mated and were said by Mr. Priour to remain throughout the year.

**Branta canadensis hutchinsi.** HUTCHINS'S GOOSE?—All the geese seen were migrating, and were at too great an altitude for me to distinguish the species, except in the case of Snow Geese, which were of course easily recognizable. On March 24, Snow Geese, and presumably Hutchins's Geese, which up to this date had been steadily migrating northward, were seen flying southward. It was clear, calm and warm, with no indication of the severe northerly wind storm which reached us on the following day, and before which the geese were evidently retreating.

**Ajaja ajaja.** ROSEATE SPOONBILL.—Two flocks, each containing seven birds, were seen April 16 at the mouth of the Nueces River. The bird is not known to breed in the vicinity of Corpus Christi, and was said by Mr. Priour not to appear there before the middle of April; presumably, therefore, after it has bred in some other locality.

**Rallus elegans.** KING RAIL.—Not uncommon in the marshes of Nueces Bay. So far as I know the call of this species has never been described. My identification of it is based on circumstantial evidence, but I have little doubt that the notes which on three occasions I have heard issue from marshes, where I had seen King Rails, were uttered by that species. This call resembles the syllables *bŭp*, *bŭp*, *bŭp*, *bŭp*, *bŭp*, uttered with increasing rapidity until the syllables are barely distinguishable, then ending somewhat as it began. The whole performance occupies about five seconds.

**Ereunetes pusillus.** SEMIPALMATED SANDPIPER. — **Ereunetes occidentalis,** WESTERN SANDPIPER.—April 25, a male of the first-named species and two females of the last-named were secured from a small flock of sandpipers.

**Recurvirostra americana.** AMERICAN AVOCET.—Not uncommon near the mouth of the Nueces River. The use of the Avocet's recurved bill is clearly explained by the manner in which the bird procures its food. In feeding they wade into the water and drop the bill below the surface until the convexity of the maxilla probably touches the bottom. In this position they move forward at a half run and with every step the bill is swung from side to side sweeping through an arc of about fifty degrees in search of shells and other small aquatic animals. The mandibles are slightly opened, and at times the birds pause to swallow their prey. It is evident that birds with a straight or a downward curved bill could not adopt this method of feeding.

**Bartramia longicauda.** BARTRAMIAN SANDPIPER. UPLAND PLOVER.—Upland Plovers were first observed March 23, and their softly-whistled call, as they arose from the prairie or flew overhead in loose flocks of five to fifteen individuals, soon became one of the characteristic bird notes. So abundant were these birds during early April that two men shooting from a gig killed one hundred and thirty in one day.

**Ægialitis wilsonia.** WILSON'S PLOVER.—Common. A nest found April 25 was placed in some short grass about fifty feet from the water. It was composed of a few straws placed at the bottom of a slight depression in the sand, and contained three fresh eggs.

**Meleagris gallopavo.** WILD TURKEY.—Wild Turkeys were common near the Nueces River twenty to thirty miles west of Corpus Christi. We found no difficulty in stalking them with the aid of a pony, and a number of specimens were secured. The greater number roost in the timber which grows on the banks of the river, but some pass the night in the hackberry 'mottes' of the chapparal.

The relationships of the Wild Turkey of southwestern Texas will be discussed in a future paper by Mr. George B. Sennett.

**Elanus leucurus.** WHITE-TAILED KITE.—Two birds of this species frequented the marshes at the mouth of the Nueces River. One was secured on April 16. They hunt by hovering over the reeds, sustaining a position facing the wind and about forty feet from the earth by a gentle movement of the wings, or occasionally, for a moment, by holding the wings upstretched over the head. Their prey seems to consist of small birds.

**Ictinia mississippiensis.** MISSISSIPPI KITE.—This species was first observed April 24, when nine individuals were seen flying northward. The following day we crossed a great flight of these birds. They could be seen to the limit of vision both to the north and south, and about twenty-five were in sight at one time. They flew northward at varying heights; some were within gunshot, while others were so far above the earth that they looked no larger than swallows.

**Parabuteo unicinctus harrisi.** HARRIS'S HAWK.—The common hawk of the region. Several nearly completed, but as yet empty nests, found April 14, were placed in the tops of the scrubby chapparal bushes about ten feet from the ground.

**Buteo borealis.** RED-TAILED HAWK.—Not common. A nest found April 23 was placed in the top of a hackberry tree about twenty-five feet from the ground. It was well made of sticks and lined with grasses, and contained two young about three days old; these with the female parent were secured, but the male was not seen. The adult specimen (Am. Mus., No. 54,997) shows an approach to *krideri;* it is without black markings on the underparts, and the tail lacks the subterminal black bar of *borealis.*

**Buteo lineatus.** RED-SHOULDERED HAWK.—Seen only in the Nueces Valley about twenty miles west of Corpus Christi.

Texas specimens of the Red-shouldered Hawk have become differentiated from true *lineatus* in somewhat the same manner as has *Buteo lineatus alleni* of southern Florida. It is not probable, however, that there is a direct connection between the Florida and Texas birds. Examples from north Florida are referable to *lineatus*, and ten adult specimens from near New Orleans are all typical of the same species.

**Speotyto cunicularia hypogæa.** BURROWING OWL.—In the paper already referred to Mr. Beckham says of this owl: "In the immediate vicinity of Corpus Christi it seemed to be abundant, as I rarely went out without seeing one or more." An increase in vegetation or some unknown cause has apparently driven this species from its former haunts. I did not see nor hear of an individual during my stay.

**Colaptes auratus.** FLICKER.—A female taken March 26 was the only bird of this species observed. In the British Museum Catalogue (Vol. XVIII, p. 18) specimens are recorded from Papalote, near Corpus Christi, and this locality apparently forms the southern limit of the Flicker's range on the west Gulf Coast.

**Pyrocephalus rubineus mexicanus.** VERMILION FLYCATCHER.—This species is unknown in the immediate vicinity of Corpus Christi, and apparently finds its eastern limit in the mesquite groves of the Nueces Valley about twenty-five miles west of the town, where, on April 24, I secured three specimens. Specimens from Texas and Arizona are alike and differ from Mexican and Central American examples in being larger with smaller bills, as the following measurements show: Six adult males from Arizona and Texas average: wing, 3.25 in.; tail, 2.32; exposed culmen, .45; six adult males from Honduras average: wing, 2.91 in.; tail, 2.13; exposed culmen, .50.

**Ammodramus lecontei.** LECONTE'S SPARROW. — On the Nueces marshes there were a few of these elusive little sparrows, and two specimens were obtained. They frequented the tall grass bordering the denser growth of reeds and sedge in which, on being flushed, they at once sought concealment.

**Ammodramus caudacutus nelsoni.** NELSON'S SHARP-TAILED FINCH.—Common in the marshes of Nueces Bay. No songs were heard, and specimens of both sexes, secured on April 16, showed no signs of breeding.

Although its occurrence is naturally to be expected, this species has apparently not hitherto been recorded from Texas.

**Ammodramus maritimus sennetti.** TEXAN SEASIDE FINCH.—A common bird in the marshes of Nueces Bay. Its song consists of four and rarely five notes; the second note is accented

and is the highest; the third and fourth resemble the first. A partially formed egg was found in the oviduct of a female killed April 16.

Comparison of the thirteen specimens secured, with an equal number of true *maritimus* in fresh breeding plumage, show this bird to be a well-marked race distinguished chiefly by its more olivaceous coloration and the black centres to the feathers of the nape and interscapular region.

**Ammodramus maritimus peninsulæ?**—March 25, in the marshes near the mainland end of the Aransas Railway trestle, I secured two specimens of a black Seaside Finch, which for the present I refer to the above-named form, from which they differ in being darker, with gray instead of olivaceous edgings to the feathers. Three other individuals, apparently similar to those secured, were seen in the same locality; but the commoner *sennetti* was not observed there. Mr. J. M. Priour assured me that this Seaside Finch was a permanent resident; a statement which I unfortunately did not have an opportunity of verifying. The subject is one of unusual interest. If this bird is a winter resident it simply extends the range of *peninsulæ*, or a close ally, from Grand Isle, La., to southwestern Texas; but if it proves to be a resident we shall have two Seaside Finches breeding in the same locality—a condition of affairs the relationships of *peninsulæ* have not led us to expect.

## **Cardinalis cardinalis canicaudus,** subsp. nov.

(Gray-tailed Cardinal.)

*Char. subsp.*—Male similar to the male of *Cardinalis cardinalis*, but with a less conspicuous black frontlet; female averaging grayer than the female of *Cardinalis cardinalis*, and with the tail feathers broadly margined with gray instead of being narrowly edged with olivaceous brown.

*Description of Male Type* (No. 54,935, Coll. Am. Mus. Nat. Hist., adult male, thirty miles west of Corpus Christi, April 23, 1891. Collected by Frank M. Chapman. Collector's No. 2002).—Head, crest, neck and underparts bright scarlet vermilion, back darker and grayer, the feathers more or less tipped with gray; wings and tail darker than the underparts, the feathers without grayish edgings; linings of the wings scarlet, paler therefore than the underparts; throat, chin, feathers at the base of the lower mandible, lores, and a narrow frontal line, which is separated from its fellow by the base of the culmen, black. Wing, 3.65 in.; tail, 4.10; culmen, .72.

*Description of Female Type* (No. 54,937, Am. Mus. Nat. Hist., breeding female, thirty miles west of Corpus Christi, Texas, April 23, 1891. Collected by Frank M. Chapman. Collector's No. 2004).—Forehead, crown, except the crest, sides of the head, except the region at the base of the bill, back and rump olivaceous gray; crest, wings and tail dull red, the feathers all margined with grayish; on the tail this grayish margin occupies nearly one-half of both vanes of the median feathers, is as wide on the outer vane of the next pair, and decreasing in width outwardly is wanting on the extreme outer feathers; underparts, except the chin and upper throat, buffy whitish, deeper on the breast and whiter on the abdomen; tibiæ reddish, mixed with buffy; linings of the wings scarlet; upper throat, chin, feathers at the base of the lower mandible and lores, grayish. Wing, 3.43 in.; tail, 3.75; culmen, .69.

*Habitat.*—Southwestern Texas, south into northeastern Mexico.

This new form of the Cardinal presents unexpected characters. The slight variation from true *cardinalis* presented by the males is towards the Arizonan *superbus;* the females, however, have departed from the *cardinalis* type in just the opposite direction; that is, the females of the eastern *cardinalis* are nearer those of *superbus* than are the females of *canicaudus*. Of the Mexican *coccineus* I have but a single specimen, a male from Vera Cruz, in fresh and unworn plumage. Its entire plumage is brighter and more deeply colored than that of *canicaudus*. The female of *coccineus* is said by Mr. Ridgway to have the capistrum "dark grayish or grayish black, very distinct"; in *canicaudus* the capistrum is grayer and less clearly defined than in *cardinalis*. The most important and striking diagnostic character in *canicaudus* is the coloration of the tail. Only one specimen in a series of twenty-six females of true *cardinalis* from the Mississippi Valley and South Atlantic States has the tail more widely margined with gray than the least typical bird in my series of twelve females from southwestern Texas. In some of the Texan specimens the gray color occupies nearly all of both vanes of the median feathers, leaving only a narrow, reddish shaft streak; in most cases the gray occupies all of the tip of the feather, and when seen from below gives the appearance of an irregular terminal grayish band.

Seasonal variation is shown by the males in the wearing away of the gray tips on the feathers of the upper surface, leaving the bird in worn breeding plumage with little or no trace of grayish

on the upper surface ; fall and winter females are browner and much more richly colored than breeding specimens.

**Embernagra rufivirgata.** TEXAS SPARROW.—A not uncommon inhabitant of the scrubby chapparal. It is a retiring bird, seldom leaving the dense growth it frequents, and for this reason is much more frequently heard than seen. So far as I am aware it has not been previously recorded from north of the Rio Grande.

**Spiza americana.** DICKCISSEL.—The first Dickcissel was seen on April 12, when a single bird was noted ; the following day several small flocks were observed, and after this date they were abundant. They moved in flocks of as many as three hundred individuals, and were so closely massed that in the distance these flocks resembled small clouds passing rapidly across the sky. When they alighted on the prairie to feed, they presented an animated sight. There was a constant passing of birds from the rear to the front of the column. Occasionally a part of a song or a single, reedy, *cack* note was heard, but as a rule the birds were silent when in flocks, and the reedy call-note was more frequently uttered by stray individuals. On cloudy nights this note was heard from birds passing overhead, which probably had wandered from their companions.

On the evening of April 19, Dickcissels, which had been flying north in great numbers, were seen flying with equal earnestness to the southward. On the morning of the following day we were visited by a terrific northwest storm of wind and rain.

**Stelgidopteryx serripennis.** ROUGH-WINGED SWALLOW.—Common ; at times even more abundant than the Tree Swallows. Frequently in walking through the marshes on Nueces Bay we would be surrounded by active bands of Swallows—the two species just mentioned, with Barn and Cliff Swallows. They would dart about us in confusing circles, almost within reach, feeding on the winged insects which our passage had roused from their resting places in the tall grass. If we paused in our tramp the Swallows immediately left us and scattered over the marsh, only to return when we resumed our journey and furnished them with a fresh supply of insect prey.

The effect of a coming northerly storm in driving migrating birds to the southward, mentioned under the preceding species, was also noticeable among Swallows, large numbers of which were seen flying southward on the evening of April 19.

**Vireo belli.** BELL'S VIREO.—A nest of this species containing four eggs was found on April 24.

**Thryothorus ludovicianus.** CAROLINA WREN.—Rare in the vicinity of Corpus Christi. A male, secured April 10, is apparently intermediate between *ludovicianus* and the Rio Grande *lomitensis*.

**Cistothorus stellaris.** SHORT-BILLED MARSH WREN.—Common in the Nueces marshes where, on April 16, it was in song. Seven specimens agree with eastern examples.

**Cistothorus palustris.** LONG-BILLED MARSH WREN.—Not uncommon in the Nueces marshes.

**Parus bicolor texensis.** TEXAN TUFTED TITMOUSE.—A single Tufted Titmouse was seen April 24, but not secured.

**Parus atricristatus.** BLACK-CRESTED TITMOUSE.—A male with a white frontlet was taken March 18, and was the only one observed.

The following list contains all the birds observed by me which were not recorded by Mr. Beckham from Corpus Christi:

Larus franklini.
Fregata aquila.
Anas fulvigula maculosa.
Branta canadensis, sub. sp.
Botaurus lentiginosus.
Rallus elegans.
Porzana carolina.
Fulica americana.
Tringa canutus.
" maculata.
" minutilla.
" alpina pacifica.
Ereunetes pusillus.
" occidentalis.
Totanus melanoleucus.
" flavipes.
" solitarius.
Bartramia longicauda.
Actitis macularia.
Charadrius squatarola.
Ægialitis meloda.
" wilsonia.
Elanus leucurus.
Ictinia mississippiensis.
Parabuteo unicinctus harrisi.
Buteo lineatus.
Haliæetus leucocephalus.
Falco columbarius.

Pandion haliaëtus carolinensis.
Strix pratincola.
Sphyrapicus varius.
Colaptes auratus.
Antrostomus carolinensis.
Chordeiles virginianus henryi.
Chætura pelagica.
Tyrannus tyrannus.
Contopus virens.
Empidonax minimus.
Molothrus ater obscurus.
Xanthocephalus xanthocephalus.
Icterus galbula.
Ammodramus lecontei.
" caudacutus nelsoni.
" maritimus sennetti.
" peninsulæ.
Peucæa cassini.
Spizella socialis.
Embernagra rufivirgata.
Guiraca cærulea.
Spiza americana.
Petrochelidon lunifrons.
Chelidon erythrogaster.
Stelgidopteryx serripennis.
Vireo noveboracensis.
Helminthophila peregrina.
Dendroica æstiva.
" pensylvanica.
Seiurus aurocapillus.
Geothlypis formosa.
Icteria virens.
Sylvania mitrata.
Harporhynchus rufus.
Thryothorus ludovicianus.
Cistothorus stellaris.
Parus bicolor texensis.
" atricristatus.

The species recorded by Mr. Beckham which were not observed by me are the following:

Urinator imber.
Sterna sandvicensis acuflavida.
" fuliginosa.
Lophodytes cucullatus.
Aix sponsa.
Aythya americana.
" vallisneria.
Glaucionetta clangula americana.
Grus americana.
Grus mexicana.
Gallinago delicata.
Hæmatopus palliatus.
Aquila chrysaëtos.
Speotyto cunicularia hypogæa.
Ceryle cabanisi.
Melanerpes carolinensis.
Pipilo maculatus megalonyx.
Oroscoptes montanus.

ARTICLE XXIII.—*Description of a New Species of Capromys, from the Plana Keys, Bahamas.* By J. A. ALLEN.

The Museum has recently received specimens of a small, short-tailed *Capromys*, collected by Mr. D. P. Ingraham on one of the Plana Keys, Bahama Islands, where he found the species abundant. Its nearest ally appears to be the *Capromys brachyurus* of Jamaica, a species (sometimes erroneously synonymized by authors* with the *Plagiodontia œdium* F. Cuvier of Hayti and San Domingo) which it resembles somewhat in external characters. It is also of interest to note in this connection that an allied form (*Capromys brachyurus thoracatus*) has been recently described by Mr. F. W. True from Little Swan Island, off the coast of Honduras.†

## **Capromys ingrahami,** sp. nov.

Similar in size and proportions to *Capromys brachyurus* Hill from Jamaica.

Pelage coarse and harsh at the surface, softer beneath. General color above mixed reddish or yellowish brown, gray, and black, giving the general effect of grayish brown. The hairs individually are plumbeous at base, passing into blackish, subapically ringed with pale yellowish gray varying to yellowish brown, the extreme tip blackish ; with these, however, are many hairs wholly blackish. Front and sides of head rather darker and with less brown ; upper surface of both fore and hind feet brighter brown than the back ; soles black, warty; basal half of tail well haired, pale rusty brown, as also the long hairs at its base, in contrast with the general coloration above ; apical half blackish, the hairs short but concealing the annulations. Below, nearly uniform pale yellowish brown, barely a little more yellowish posteriorly. Ears of the usual form in *Capromys*, blackish, scantily haired on both surfaces, slightly fringed with dusky hairs on the anterior border. Whiskers long, blackish. Thumb rudimentary, being little more than a tubercle armed with a very short nail.

*Measurements.*—Head and body (two specimens), 280 to 320 mm.; tail vertebræ (still *in situ* in one specimen), 55 ; hind foot, 53 to 55 ; fore foot, 30 to 32 ; ear, height from crown, 16 ; greatest width, 17.

*Skull.*—Total length, 63 mm.; greatest width, 32; least width between orbits, 17.5 ; length of nasals, 21 ; length of frontals, 21 ; length of upper molar series, 15 ; distance between inner margins of the upper anterior molars, 2.5 ; distance between inner margins of posterior molars, 5.5 ; distance from anterior upper molars to incisors, 16 ; length of lower jaw (tip of incisors to posterior edge of condyle), 44 ; tip of incisors to tip of coronoid process, 48 ; height of condyle, 18.5 ; length of lower molar series, 14.5.

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* *Cf.* Trouessart, Cat. Mam. viv. et foss. Fasc., III, p. 125.
† Proc. U. S. Nat. Mus., 1888, p. 469.

A second and somewhat older skull is slightly larger (total length, 66 mm.), but not otherwise different.

Type, No. $\frac{3968}{3032}$, Am. Mus. Nat. Hist., Plana Keys, Bahamas, Feb., 1891; D. P. Ingraham.

Mr. Ingraham collected 20 specimens of this animal, 14 of which he has kindly transmitted to me for examination, together with his MS. notes on their habits. The skins are distorted, unfilled specimens, and hence unsatisfactory for study and measurement. The above description was based on two specimens kindly presented by Mr. Ingraham to the Museum. The 12 additional specimens since received enable me to speak further of their external characters. The majority of the specimens present no very noteworthy differences from those above described. As nearly as can be judged they are nearly all of about the same size; several are smaller and evidently (judging by the femora attached to the skins) younger than the others. Unfortunately the specimens are not labeled with the sex, and it is impossible to determine the sex from the skins. Mr. Ingraham assures me, however, that he noticed no sexual difference in either size or color.

As regards coloration, some are quite strongly suffused with yellowish and have less black; others are faintly suffused, giving the general effect above of pale yellowish gray mixed with black. Below the color varies from soiled white faintly suffused with buff to rather strong buff. In most specimens the area surrounding the base of the tail, and also the basal third or half of the upper surface of the tail (sometimes the whole upper surface of the tail) is strongly rufescent brown; in other specimens this region is nearly or quite concolor with the back. A single specimen is melanistic, being entirely brownish black, varying to nearly black over the median line of the dorsal region, mixed with reddish brown, more especially over the lower back, sides of the body and feet.

Mr. Ingraham has kindly furnished the following notes respecting the discovery and habits of the animal it gives me pleasure to name in his honor, in recognition of his work as a collector during several winters spent by him in the Bahamas and in Yucatan. He says:

"On the morning of February 11, 1891, we anchored under the lee of the easternmost of the Plana Keys, in latitude about 22° 33′ north, longitude 72° 30′ west, and about half-way between the northeast point of Acklin Island and Mariguana of the Bahamas; and on going on shore we saw unmistakable signs of the little rodent known among the natives as the 'Hootie' [=Hutia].

"The key is a small rocky islet, the highest point of which is probably not more than fifty feet above the surrounding ocean, with crevices and caves worn in the rocks by the action of water, and in many places broken strata of rocks piled upon each other, leaving cracks and crevices between and beneath them. The islet may be slightly more than half a mile wide and four or five miles long, entirely without fresh water except in the rainy season, when pools of fresh water may be found in the holes in the rocks. There is a small growth of shrubby bushes in the rocky crevices, and in some parts of the lower ground a growth of black button-wood, and on the western end of the islet a light growth of the silver-leaved palm, with here and there different forms of cacti scattered over the island. A few paw-paw trees were also found where the seeds had evidently been dropped. About a mile and a half west of the key is another small key, of about the same size and of the same geological formation, but separated from it by a deep passage. This is the only land within twenty miles or more, and my sailing charts indicate a depth of water of several thousand feet.

"Although these islands are only about a mile and a half apart, their fauna is very distinct outside of a small lizard common to all of the rocky islands of that part of the Bahamas.

"The 'Hootie' [Hutia] occupies only the eastern island, which, with the lizard and a few varieties of birds, constitutes its entire [vertebrate] fauna. Neither am I able to learn of its being found in any other portion of the Bahamas.

"During my stay of two weeks, weather bound, under the lee of the island, I secured about twenty specimens of this animal, which at first I thought was gregarious in its habits, or inclined to live in colonies, but the occurrence of so many individuals at this point may have been due to the favorable conditions of the locality for affording it hiding places. I once saw quite a num-

ber together away from the rocks, among the palmettos, but on a subsequent visit to the island I came to the conclusion that the gathering was on account of its being about the rutting season. Its food was the leaves, twigs and bark of the bushes, especially the black buttonwood, and the succulent growth of the cactus plants. It seemed very fond of the fruit of the paw-paw, and even of the body of the tree itself, as I have seen the trunks of this tree, nearly as large as my body, eaten so nearly off that they would not sustain their own weight. A sweet potato left on the shore was eaten up, while the body of a bird, left to tempt them, was untouched.

"When wounded it seldom made any attempt to defend itself, although in one instance, when I put my foot on a wounded one, it tried to bite me. It feeds mostly by night, although found occasionally foraging during the day. I saw no indication of its burrowing, the numerous holes and crevices in the rocks perhaps rendering this unnecessary. In its movements and shape when running it reminded me very much of the Muskrat. It would run nearly as fast as I could. I had to shoot most of the specimens I obtained, but I secured a few, down in the palmettos, by chasing them and stamping on them, as they ran under the palmetto leaves. It was not shy, as when it was away from the rocks I could approach within twenty-five or thirty feet of it by moving cautiously, when it would take to the rocks.

"I opened a number of the animals during my stay for the purpose of securing a fœtus for an alcoholic specimen, but failed to obtain any."—INGRAHAM, *MS. Notes.*

As intimated at the beginning of this article, *Capromys ingrahami* is most nearly allied to the Jamaican *C. brachyurus* Hill, so far as can be judged by descriptions, no specimens of it being known to be extant in this country. Through the kindness of Mr. F. W. True, Curator of Mammals at the U. S. National Museum, I am able to make a direct comparison of *C. ingrahami* with his *Capromys brachyurus thoracatus*, from Little Swan Island, off the coast of Honduras, of which he has sent me the skull of the type and one of the two skins on which the subspecies was based. In general effect the coloration of some of the Plana Keys specimens

is indistinguishable from the skin of *C. b. thoracatus;* others, however, are more suffused with reddish brown. *C. ingrahami* is a much smaller animal, with a relatively longer tail. The skulls of the two forms show the same discrepancy in size, and besides differ much in various structural details. The anteorbital portion of the skull in *C. ingrahami* is much smaller, with the nasals much narrower and much less arched at the anterior border; the anterior palatine foramen is one-half narrower and much shorter; the maxillary portion of the zygomatic arch is much less expanded laterally, and the palatal surface is more deeply pitted in front of the molar series; the palatine surface is less extended posteriorly, terminating on a line separating the third and fourth molariform teeth, instead of extending as far as the posterior border of the last molar. The most striking difference is seen in the form of the zygomatic arch, the malar being one-third less in vertical expansion, and lacking entirely the angular expansion at the lower posterior border, which forms so prominent a feature in *C. b. thoracatus* (see Figs. 9 and 10), and also in *C. pilorides* and *C. prehensilis.* The two forms also differ slightly in details of dentition (see Figs. 1 to 4), and in the form of the mandibular rami.

*C. ingrahami* appears to resemble *Plagiodontia ædium* of Hayti in size, coloration, and in its relatively short tail, but it being a true *Capromys* needs no further comparison with *Plagiodontia.*

The present is by no means the first record of *Capromys* from the Bahamas. Catesby's *Cuniculus bahamensis* is evidently one of the larger species of the genus, but which one, or whether really from the Bahamas, is at present beyond determination. Columbus, however, on his first voyage to the West Indies, evidently found some form of the genus abundant at nearly all of the several Bahama Islands he visited; and Mr. C. B. Cory informs me that "a peculiar large rat, probably a *Capromys,*" is said to occur abundantly on the island of Mariguana, a few miles to the eastward of Plana Keys. Mr. Ingraham, however, replying to my inquiries on this point, writes me that he spent from the 22d of February to the 30th of March, 1891, at the island of Mariguana. He says: "The island has a coast line of about seventy-five or eighty miles, and I have walked nearly or quite half of this dis-

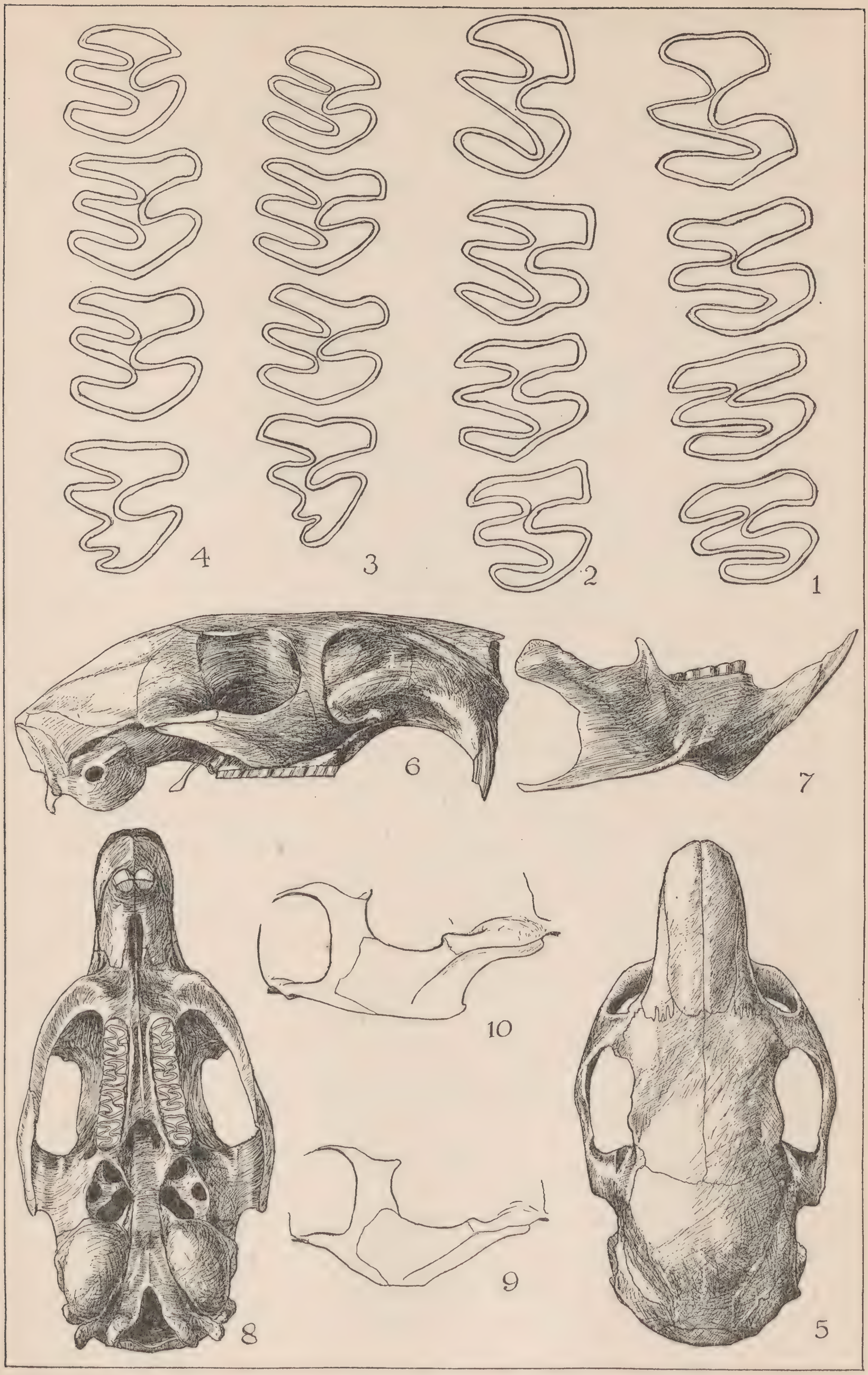
tance. I have been four or five miles into the interior, and indeed there is not a part fifteen miles in extent that I have not visited. I saw no signs of *Capromys* anywhere on the island, nor did I hear of any such animal from the inhabitants, who, however, repeatedly told me of the 'Hootie' on the Plana Keys. Hence I may say unhesitatingly that it is not found on the island of Mariguana."

Mr. Ingraham, who has visited a large number of the keys and islands of the Bahama group, further informs me that he has never heard of the existence of any similar animal elsewhere in the Bahamas. An animal so helpless and easily destroyed as the Hutia may, however, have formerly existed at many points in the Bahamas and Antilles, where it is now extinct.

The first European explorers of the West Indies found these peculiar rat-like animals abundant in various parts of the Antilles, and vague descriptions of them were given under their various native names by the writers of the sixteenth and seventeenth centuries, notably by Oviedo in his "Historia general de las Indias," published in 1547, and later by Rochefort, Duturtre, and Browne. As these little beasts were in great quest as food, from the delicacy of their flesh, by both the natives and the Spanish colonists, they quickly began to become scarce, a fact noted even by Oviedo, who says they were hunted by dogs brought from Spain. They were so common in Jamaica at the time of Columbus's visit that he is said to have "victualled the famous canoe expedition of Diego Mendez with them."* The narrators of his voyage make frequent mention of their abundance not only in the Bahamas and at Jamaica, but also in Cuba and Hispaniola. Oviedo speaks of three kinds, and later writers mentioned others, without, however, describing them so as to give a very clear conception of their characters. They have been referred to as occurring throughout the Greater Antilles, except in Porto Rico, and in the Bahamas. The earlier natural history compilers introduced them into their works, greatly to the distraction of later systematic writers.

Although these animals are apparently still not uncommon at certain localities on the larger islands, they have doubtless everywhere greatly decreased in numbers, and probably at many points

* Zool. Journ., Vol. IV, 1829, p. 277.




1, 3, 5–9, Capromys ingrahami; 2, 4, 10, C. brachyurus thoracatus.

(1–4, *about four times natural size;* 5–10, *natural size.*)

have been wholly extirpated. Though said to be still common in Hayti and San Domingo, and in portions of Cuba, they have been practically exterminated in Jamaica. Specimens, however, are very rare in collections, and even at this late day our knowledge of the group is very inexact, while some of the forms have doubtless already become extinct.

Five or six species have of late years been commonly recognized, about as follows :

1. *Capromys pilorides* (Say). Hab. Cuba.
2. *Capromys prehensilis* Poeppig. Hab. Cuba.
3. *Capromys brachyurus* Hill. Hab. Jamaica. Now nearly extinct.
4. *Capromys brachyurus thoracatus* True. Hab. Little Swan Island, off coast of Honduras.
5. *Capromys ingrahami* (as above described). Hab. Easternmost of the Plana Keys, Bahamas.
6. *Plagiodontia ædium* F. Cuvier. Hab. San Domingo.

Of doubtful status is *Capromys melanurus* Poey, from Cuba. Possibly some of the other supposed nominal species may have a valid basis, as I have before me three distinct species alleged to have come from Cuba. Besides, I am informed on credible authority that a long-tailed, as well as a short-tailed, Hutia is found in Hayti. Nothing however can be done in the way of a satisfactory revision of the group with the material at present accessible in American museums.

## *Explanation of the Figures.*

Fig. 1. Pattern of enamel folds, left upper molar series, in *Capromys ingrahami* (No. $\frac{3033}{3969}$, Am. Mus.).

" 2. Same, in *C. brachyurus thoracatus* True (No. $\frac{22691}{15897}$, U. S. Nat. Mus.).

" 3. Same, left lower molar series, in *C. ingrahami*. From same specimen as Fig. 1.

" 4. Same, left lower molar series in *C. brachyurus thoracatus*. Same specimen as Fig. 3.

" 5–8. *C. ingrahami*. Figs. 5–7 from same specimen as Figs. 1 and 3; Fig. 8, from a somewhat older and larger specimen (No. $\frac{3032}{3968}$, Am. Mus.), No. $\frac{3033}{3969}$ having the base of the skull imperfect.

" 9. Zygoma of *C. ingrahami* from same specimen as Figs. 1, 3, 5–7.

" 10. Zygoma of *C. brachyurus thoracatus* True, from same specimen as Figs. 2 and 4.

ARTICLE XXIV.—*On a Collection of Birds from Chapada, Matto Grosso, Brazil, made by Mr. Herbert H. Smith.* By J. A. ALLEN.

## PART I.—OSCINES.

The present collection was formed under the direction of Mr. Herbert H. Smith, the well-known Brazilian explorer and entomological collector, by members of his party, during the years 1882–86, chiefly in the immediate vicinity of Chapada, in the Province of Matto Grosso, Brazil. The collection numbered about 6000 specimens, of which 4000 were purchased by the American Museum of Natural History in 1887, when the collection first reached this country. All but about 500 specimens of the remaining 2000 are still in storage at this Museum, and through the kindness of Mr. Smith have been used in the preparation of the present paper, which is thus based on a strictly local collection of about 5500 specimens,—doubtless by far the largest and most important single collection of birds ever made for scientific purposes from a limited district anywhere in South America.

Chapada is in the Campo region of the Bolivian border of Matto Grosso, about thirty-five miles southwest of Cuyaba, on a tributary of the Cuyaba River, at an altitude of about 2500 feet. The forests are limited to the edges of the table land and the borders of the streams, with here and there little islands of forest growth in the Campo.

About nine-tenths of the collection was made within a radius of ten miles from Chapada; the greater part of the rest on occasional brief collecting trips to other points varying from fifteen to thirty-five miles distant from Chapada. These points are: (1) Abrilongo, twelve miles from Chapada, at an altitude of about 1500 feet; (2) Cachoeira, about thirty miles distant, with an estimated altitude of 1200 feet; (3) Cuyaba, about thirty-five miles northeast from Chapada, with an altitude of 1500 feet. Besides these points, about four months were spent in the vicinity of Corumba, 300 miles south of Chapada, in the flood plain of the Paraguay River. In the following list, when no locality is especially mentioned, Chapada or its immediate vicinity is to be understood.

The bird collection, though so large, was made incidentally to the special work in hand, namely, an exhaustive collection (about 400,000 specimens were obtained) of the insect fauna of the region. The greater part of the specimens were prepared by Mrs. Herbert H. Smith, whose later work in a similar line in Mexico for Messrs. Salvin and Godman has called forth generous recognition and hearty commendation. (See Ibis, 1889, p. 240.) Much of the collecting was done by her brother, Mr. A. E. Smith, with the aid of two German lads employed as assistants.

Bird collecting at Chapada was steadily prosecuted for three years, without regard to season or the condition of the birds. Hence the species, when at all common, are represented in large series, and include all phases of plumage, from the half-fledged young to old birds in worn plumage or in molt. The best portion of the year for collecting proved to be the rainy season, lasting from September till March, which period includes the breeding season. In the dry season the birds were fewer and more difficult to obtain. As, however, many of the birds are of local distribution over the area included in the field of operations, in accordance with their predilection for an open or a forested country, and as the work was carried on now at one point and now at another, the same species is rarely represented equally throughout the different months of the year, even when a permanent resident of the region.

Although, as already stated, the collection was not made by professional ornithological collectors, it numbers not far from 350 species, and may be considered as fairly exhaustive for the locality. Unfortunately the specimens are unaccompanied by notes, beyond the date of collection, the sex as determined by dissection, the color of the eyes, and measurements of the specimen before skinning.* No notes were made as to the habits or relative abundance of the species; hence the specimens themselves and the dates of collecting are the only data as to the relative abundance or seasons of occurrence of the species. A small collection of eggs accompanying the birds, and the many newly-fledged birds, indicate the months of October and Novem-

* These latter, however, have not been used in the present paper, it seeming preferable to have the measurements taken by a single person under my own supervision. The measurements here used have been carefully made by Mr. C. B. Isham, an assistant in this Department of the Museum.

ber as the breeding season of the resident species, which, in some instances at least, appears to extend from the latter part of September till into December. The season of molt varies somewhat with different species, but in general terms may be said to extend from the latter half of December till into March. It evidently begins a month or two earlier in some species than in others.

The larger series throw much light on phases of plumage due to age and sex, and often include phases not heretofore described, including females of species hitherto known only from the male sex. They also add much to our previous knowledge of the range of individual variation in respect to size, coloration, etc., of a large number of even the commoner species. Many species hitherto rare in collections are often represented in series of 30 to 50 specimens. The collection, however, as a whole, contains singularly few duplicates, for generally so many specimens are required to represent the seasonal and other variations of the species, that when these are set aside few are left as duplicates.

Since this collection came into the possession of the Museum, some four years ago, much use of it has been made in the general work of the Museum on South American birds, and several papers have already been published based in part or wholly on this material. These include (1) "Descriptions of New Species* of South American Birds, with Remarks on various other little known Species" (this Bulletin, Vol. II, No. 3, pp. 137–151, June, 1889); (2) "On *Cyclorhis viridis* (Vieill.) and its near Allies, with Remarks on other Species of the Genus *Cyclorhis*" (*ibid.*, pp. 123–135, June, 1889); (3) "Remarks on Individual and Seasonal Variation in a large series of *Elainea* from Chapada, Matto Grosso, Brazil, with a Revision of the Species of the restricted Genus *Elainea*" (*ibid.*, pp. 183–208, Oct., 1889); all by the present writer. New species or subspecies elsewhere described are (1) *Xiphorhynchus rufodorsalis* Chapman (this Bulletin, II, p. 160, July, 1889), and (2) *Xiphocolaptes major castaneus* Ridgway (Proc. U. S. Nat. Mus., XII, 1889, p. 17).

In revising the nomenclature of the species here treated it has been found necessary to adopt in a few instances earlier names

* The following new species are from the Smith Collection: (1) *Platyrhynchus bifasciatus*, (2) *Euscarthmus ochropterus*, (3) *Sublegatus virescens*.

than those heretofore in current use, notably certain of the names given in 1773 by Philipp Ludwig Statius Müller in the Supplement volume of his edition of Linné's "Systema Naturæ." Although attention was called to these names by the late John Cassin in 1864 (Proc. Acad. Nat. Sci. Phila., 1864, pp. 234–257), and some of them have since been adopted, others have been ignored, according to the predilections of the different authors who have had occasion to treat the species to which Müller's names relate.

**1. Turdus fuscescens** *Steph.*—Two specimens—♂, Feb. 21, 1883; "♀?" Nov. 4, 1882, both taken at Chapada. These specimens extend the range of this species far south of any point from which it has been previously recorded. Mr. Seebohm (Cat. Bds. Brit. Mus., V, 1881, p. 204) gives its South American distribution as "north of the Amazon."

**2. Turdus fuscescens salicicolus** *Ridgw.*—A single specimen (♀) typically representing this subspecies was taken March 27, 1883. It is of special interest, not only on account of the latitude, but as offering a case of a western North American race migrating far south in South America, instead of remaining in Mexico or Central America, as is the rule with these western forms.

**3. Turdus albicollis** *Vieill.*—This species is represented by three specimens, as follows: ♂, June 6, 1885; ♀, Oct. 28, 1882; a half-grown fledgling, Nov. 23, 1882.

The female is much browner above than the male, with the head nearly concolor with the back, and the throat markings are brownish instead of deep black. In the male the head is dusky, washed with olive, and the throat black narrowly streaked with white, the black on the throat in both sexes greatly predominating over the white.

The half-fledged bird has the upper surface much darker than in the adult, with the scapulars and interscapulars obscurely tipped with blackish, and with conspicuous shaft-stripes of pale chestnut; wing-coverts all tipped with pale chestnut, the lesser coverts also with shaft-stripes of the same color. Below blotched with broad cross-bars of blackish, the breast and sides pale yellowish brown, the middle of the abdomen white.

A set of three eggs accompanies the female, taken October 28, 1882. They measure 1.08 x .80 in., 1.05 x .82, 1.09 x .82 in. The ground color is bluish white, thickly sprinkled with fine dots of reddish, with very large patches of the same color, sometimes nearly covering the larger end, mixed with similar blotches of lilac brown.

**4. Turdus albiventer** *Spix.*—This species is represented by a series of 19 specimens, including about an equal number of males and females, one young bird in first plumage, and also a nest and two sets of eggs. These latter were taken Oct. 12 and Oct. 19, and the full-grown fledgling Nov. 28. Specimens were collected in nearly every month of the year, showing the species to be resident.

There is considerable seasonal variation in color, breeding birds (taken Oct.–Nov.), as compared with specimens collected in March and April, often presenting a strong shade of cinnamon on the breast and abdomen, of which there is only very slight trace in what may be termed 'winter' specimens. The forehead is often decidedly brownish or washed with rusty, irrespective of season, though generally most strongly so in the female, which has the whole head usually browner and more nearly concolor with the back than in the male. The female also averages slightly smaller than the male, in which the wing ranges from 4.45 in. to 4.76, against 4.28 to 4.54 in the female.

The young bird in first plumage differs from the adults in being everywhere washed with pale cinnamon below, marked with faint blackish cross-bars; the general color above is much less olivaceous, with narrow whitish shaft-lines, and all the coverts conspicuously tipped with pale rusty.

Eight or ten sets of the eggs, taken at different dates in October, of this species, show the eggs to be very variable in size and form as well as in color. They are generally elongated, measuring about 1.15 x .90 in. The ground color varies from pale clear bluish white to a yellowish bluish white; the markings are generally fine, in the shape of oblong reddish brown dots, covering from about one-third to nearly the whole of the surface. The markings vary in color from russet brown to hazel.

**5. Mimus modulator** (*Gould*). — This species is probably resident, as in the series of 25 specimens each month of the year is represented except February and October. The specimens taken in April, May, June, and July are nearly all more or less strongly suffused below with buff, as compared with specimens taken later in the season, some of which latter present almost no buffy tinge. There is evidently much individual variation in this respect, specimens taken at nearly the same date differing greatly in the amount of buffy suffusion of the ventral surface. In January the dark dull gray is generally but slightly tinted with buff. The breast and fore-neck are generally at all times distinctly ashy, in contrast with the lighter throat and abdomen. The amount of rusty brownish suffusion on the lower back and rump is similarly variable, as are other features of the coloration, including the dusky stripes on the flanks.

The length of the wing in the males ranges from 4.06 to 4.38 in., the tail from 4.60 to 5.00, the exposed culmen from .67 to .78. Ten males average as follows: wing, 4.19; tail, 4.84; exposed culmen, .73. Six females average: wing, 4.06; tail, 4.77; culmen, .73. The females thus average slightly smaller than the males.

A set of three eggs, collected Nov. 7, 1882, is accompanied by the parent. They measure 1.03 x .80. The ground color is bluish white, marked thickly over the whole surface with pale reddish brown, but more thickly over the larger end.

**6. Mimus triurus** (*Vieill.*).—Represented by a single specimen from Piedra Blanca, Bolivia, April 22, 1886.

**7. Polioptila dumicola** (*Vieill.*). — One specimen, ♂ ad., Corumba, April 12, 1886.

**8. Polioptila boliviana** *Scl.*—Thirteen specimens, as follows: Chapada, January and May, 10 specimens; Abrilongo, Feb. 20, 1885, 2 specimens; Cachoeira, Feb. 4, 1886, 1 specimen. These all agree in the whiteness of the underparts, and other characters, distinguishing *P. boliviana* from *P. dumicola*, as claimed by Baird (Rev. Am. Birds, 1864, p. 73), and especially by Leverkühn (Journ. f. Orn., 1889, p. 109). They are, however, closely related, and may be merely geographical races of the same species.

**9. Donacobius atricapillus** (*Linn.*).—Two specimens, ♂ and ♀ ad., Corumba, Feb. 27, 1886.

**10. Campylorhynchus unicolor** *Lafr.*—Two specimens, an adult and a young bird partly in first plumage, Uacuryzal (near Corumba), Feb. 14, 1886.

In the young bird the interscapulars are tipped with a broad blotch of dusky, with below this a broad bar of the same color, bordered both above and below with a broad bar of grayish fulvous, giving the effect of two light and two dark bars across each feather, with a whitish shaft-streak. In the adult the interscapulars are distinctly blotched with dusky brown,—a feature not mentioned by Mr. Sharpe (Cat. Bds. Brit. Mus., VII, p. 190).

**11. Troglodytes musculus** (*Naum.*).—This species is represented by 10 specimens, taken in April, May, July, September, October, and November. They present considerable variation in respect to the distinctness of the narrow bars on the back and in the depth of the rufous tints.

**12. Thryophilus galbraithi** (*Lawr.*).—A single specimen, ♀ ad., Chapada, Jan. 17, 1883, is provisionally referred to this species, which some authors (Salvin & Godman, Biol. Centr.-Am., Aves, p. 85) synonymize with *T. leucotis* (Lafr.). Compared with a series of four Panama specimens of *T. galbraithi*, including the type, it is on the whole slightly paler, and the ear-coverts are a little more strongly streaked with brown, but the average differences between this specimen and the Panama birds are not greater than those between the extremes of the Panama series. It is doubtless the *T. galbraithi* of Pelzeln (Orn. Bras., p. 47) from Goiaz and Cuyaba, and may prove separable as a race or subspecies of the *T. leucotis* group (*cf.* Sharpe, Cat. Bds. Brit. Mus., VII, p. 209, footnote). Unfortunately specimens of true *T. leucotis* are not available for examination.

**13. Thryothorus genibarbis** *Swains.* — The 15 specimens representing this species were taken as follows: April, 1; May, 8; June, 3; August, 1; September, 1; October, 1.

In coloration the series is very uniform, the depth of color varying within rather narrow limits. In three the bars on the

terminal half of the tail are broken and irregular, instead of sharp and regular as is usually the case. The series measures as follows: wing, 2.26–2.59 in., averaging 2.45; tail, 2.28–2.64, averaging, 2.47; exposed culmen, .59–.67, averaging, .63.

**14. Anthus rufus** (*Gmel.*). — Two specimens, ♂ and ♀, Corumba, Feb. 28 and March 2, 1886.

**15. Compsothlypis pitiayuma** (*Vieill.*).—Chapada, 6 specimens, taken April 7, July 11, and Sept. 3–26; Abrilongo, 1 specimen, Feb. 18.

**16. Geothlypis velata** (*Vieill.*). — Corumba, 1 specimen, ♂ ad., Feb. 4; Chapada, 31 specimens (22 ♂, 8 ♀, 1 juv.), taken as follows: January, 2; February, 1; March, 3; April, 7; June, 1; July, 2; August, 3; September, 5; October, 4.

The young males at first resemble the females; at apparently the second molt they begin to assume the livery of the male, acquiring gradually the ashy cap and the black frontlet and eye-stripe. This molt begins in February and is completed in April, although the auriculars may not become wholly black till later, the auriculars remaining olive, or mixed olive and black, after the ashy cap and the black of the forehead and lores have been fully acquired.

A young bird just out of the nest is uniform olive sepia above, with the breast and flanks umber, passing into pale maize yellow on the abdomen.

**17. Basileuterus hypoleucus** *Bon.* — This species, usually rare in collections, is represented by a series of 81 specimens, taken as follows: January, 7; February, 9; March, 12; April, 9; May, 11; June, 7; July, 9; August, 6; September, 5; October, 4; November, 0; December, 2. Two or three of the January specimens are slightly in molt—the only examples showing signs of molt. What seem to be young birds are washed faintly with pale buffy brown on the flanks and occasionally over most of the ventral surface, and the olive green of the back is faintly obscured with brown anteriorly. Birds in very high plumage show a wash of olive yellow over the middle of the breast and belly, in a few examples amounting to a more or less distinct central spot on the lower breast.

Twelve males measure as follows: wing, 2.34–2.58 in., averaging 2.47; tail, 2.28–2.54, averaging 2.37; exposed culmen, .38–.43, averaging .41. Twelve females are somewhat smaller, as follows: wing, 2.22–2.40, averaging 2.30; tail, 2.14–2.35, averaging 2.23; exposed culmen, .39–.42, averaging .40.

**18. Basileuterus leucophrys** *Pelz.*—Two specimens, ♂ and ♀, Chapada, Oct. 20, 1883.

**19. Basileuterus flaveolus** *Baird.*—A series of 54 specimens, representing every month of the year except December, taken as follows: January, 1; February, 4; March, 6; April, 4; May, 11; June, 3; July, 5; August, 3; September, 4; October, 8; November, 5. Specimens taken after the fall molt are deeper yellow below than specimens collected in the breeding season, but are not otherwise different. The series as a whole presents remarkable uniformity in coloration. Specimens from Bahia, from the Lawrence Collection, are not appreciably different.

Thirty males give the following measurements: wing, 2.32–2.60 in., averaging 2.50; tail, 2.34–2.69, averaging 2.55; exposed culmen, .45–.52, averaging .47. The females are slightly smaller.

Two eggs of this species, taken with the parent birds, Oct. 21, 1882, are dull white, marked with bright reddish brown dots, which are small and much scattered over the smaller end, and aggregated at the larger so as to nearly cover the surface. They measure .80 x .60.

**20. Vireo chivi** (*Vieill.*).—The series of 42 specimens was taken as follows: January, 3; February, 6; March, 1; April, 3; August, 3; September, 11; October, 10; November, 3; December, 2. The months of May, June, and July are unrepresented, or more strictly, the period from April 7 to August 13—about four months of the winter season. The species is thus apparently a migrant in the vicinity of Chapada. One of the November specimens (Nov. 27) is still partly in first plumage, the head being buffy brown, with more or less brown mixed throughout the upper plumage.

In this large series there is a comparatively small range of variation in either size or coloration. Ten males, selected at random, measure as follows: wing, 2.70–2.92 in., averaging 2.80;

tail, 1.95–2.22, averaging 2.17; exposed culmen, .45–.54, averaging .49. In the female the wing averages 2.70 and the tail 1.97.

**21. Vireo olivaceus** (*Linn.*).—With the preceding are two examples that must be referred to *V. olivaceus*, a male taken Dec. 21, 1882, and a female, Feb. 14, 1883. In neither size nor color can they be distinguished from average specimens from the United States. These two specimens measure as follows: wing, ♂, 3.18, ♀, 3.21; tail, ♂. 2.22, ♀, 2.28; exposed culmen, .50—the same in both specimens.

**22. Cyclorhis viridis** (*Vieill.*). — The series of nearly 50 specimens of this species has been made the subject of a special paper (*cf.* this Bulletin, Vol. II, No. 3, pp. 123–135, June, 1889).

**23. Hirundo erythrogastra** (*Bodd.*). — Corumba, 3 specimens, March 23, 1886. The chestnut band on the forehead is a little narrower and the bill slightly smaller than in average examples from North America, but they are not otherwise different. The gloss of the upper parts is the same as in the North American bird.

The generic name *Chelidon* Forster, 1817, proves to be a pure synonym of *Hirundo* Schäffer (ex Linn.), 1774, as shown by Reichenow (Journ. für Orn., 1889, p. 187).

**24. Progne tapera** (*Linn.*).—The specimens of this species, 15 in number, were taken as follows: Chapada, September, 5; October, 1; November, 4; January, 1; Corumba, 2, Dec. 1, 1883, and April 1, 1886; Uacuryzal, 2, Feb. 16, 1886.

**25. Progne domestica** (*Vieill.*).—Three specimens (♂ ad., ♂ juv., ♀ ad.), Chapada, Sept. and Oct., 1882.

**26. Atticora cyanoleuca** (*Vieill.*). — One specimen (♂ ad.), Chapada, Sept. 10, 1885.

**27. Atticora fucata** (*Temm.*).—Two specimens (♂ and ♀ ad.), Chapada, Aug. 31 and Sept., 1883.

**28. Dacnis speciosa** (*Wied*).—Chapada and Corumba, 7 specimens (5 ♂ and 2 ♀), February, April, July, and August. These specimens measure as follows: wing, 2.15–2.40 in., averaging 2.22; tail, 1.50–1.75, averaging 1.63; exposed culmen, .36–.39, averaging .38. There is apparently no sexual difference in size.

**29. Dacnis cayana** (*Linn.*).—This species is represented by 132 specimens, taken as follows: January, 5; February, 11; March, 4; April, 38; May, 14; June, 6; July, 13; August, 13; September, 8; October, 9; November, 2; December, 4; without date, 5. Of this number 38 are adult males in breeding livery, 14 are young males in transition plumage, the remaining 80 being either females or young males indistinguishable from females in plumage. The young males in particolored plumage have the wings and tail black, and the body plumage variously mixed; a very few blackish feathers on the throat and interscapulium, and a few blue feathers scattered throughout the ventral surface.

Three December specimens are very young birds, still partly in nestling plumage, which is like that of the female, only the colors are all duller and paler.

A series of 20 adult males gives the following measurements: wing, 2.64–2.76 in., averaging 2.71; tail, 1.74–1.90, averaging 1.79; exposed culmen, .48–.55 averaging .51. A series of 10 adult females gives the following: wing, 2.52–2.79, averaging 2.63; tail, 1.56–1.90, averaging 1.76; exposed culmen, .50–.54, averaging .51.

The Chapada birds agree almost exactly in color with specimens from Bahia and other parts of eastern Brazil. Cayenne and Bogota skins are darker and less greenish, being, as would be expected, intermediate between the specimens from southern Brazil and the still darker Panama phase, described by Mr. Lawrence as *D. ultramarina*.

**30. Arbelorhina cyanea** (*Linn.*). (*Cœreba cyanea* auct.)—The series of 60 specimens (41 ♂, 19 ♀) of this species was taken as follows: January, 3; February, 4; March, 2; April, 2; August, 13; September, 23; October, 11; November, 2. There are no specimens taken between April 11 and August 22, nor between November 5 and January 17, the period of abundance being apparently from about August 20 to October 10. The only specimens not in fully adult plumage are four males, dated as follows: Sept. 13, Jan. 17, Feb. 14, and Feb. 21 (two). Two of these show merely traces of the immature plumage, and two are in a patchy condition in which about one-half of the plumage is that of

the adult male and the rest that of the female. One has the wings and the tail black, with the rest of the plumage as in the female, except that the lesser wing-coverts are mixed blue and green, with small patches of blue on the sides of the lower back and single blue feathers scattered here and there.

A series of 15 adult males, selected at random, measure as follows: wing, 2.57–2.76 in., averaging 2.68; tail, 1.46–1.68, averaging 1.58; exposed culmen, .48–.59, averaging .54. A series of 10 adult females presents the following: wing, 2.50–2.62, averaging 2.56; tail, 1.45–1.61, averaging 1.53; exposed culmen, .60–.64, averaging .62. Thus while the female is the smaller bird, the bill is absolutely considerably longer.

An egg of this species, taken with the parents, Oct. 13, 1882, is white spotted with pinkish vinaceous, rather sparingly except over the larger end, where the spots cover about two-thirds of the surface. It measures .75 × .55.

**31. Cœreba chloropyga** (*Cab.*). (*Certhiola chloropyga* auct.)—This species is represented by 4 specimens from Abrilonga, 1 from Cuyaba, and 72 from Chapada, a total of 79, taken as follows: January, 4; February, 6; March, 7; April, 21; May, 2; June, 1; July, 11; August, 8; September, 11; October, 3; November, 3; December, 2.

Males and females are apparently indistinguishable in color, but in size the females are slightly the smaller. Apparently at least two years are necessary for the acquisition of the fully adult plumage. In young birds the upper plumage is dull brown, more or less strongly tinged with olive, the head concolor with the back; throat dull grayish white, faintly cross-barred with black, and stained faintly with buffy olive; rest of the lower surface pale dull greenish with the flanks and crissum more or less buffy; outer tail-feathers with the white spots wholly obsolete or only slightly indicated. Birds in this phase of plumage occur throughout the year.

About one specimen in ten of the adults shows a slight trace of white beyond the primary wing-coverts, but only in about one in twenty is it distinct enough to readily attract attention. Compared with Bolivian and Bahia specimens the latter are darker and the bill slenderer, the Chapada series being of a more oliva-

ceous brown above with a rather stouter bill, which, however, varies much in size in different specimens. It is difficult to find a specimen in the whole Chapada series as dark as average skins from Bahia, Cayenne, or northern Bolivia, the duller, more olivaceous brown of the back in the Chapada bird being thus a noticeable feature. Probably the bird of the Campo district of southwestern Brazil will prove separable from the bird of the coast and Amazonian regions as at least a well-marked geographical race.

A series of 10 adult males and 10 adult females measure as follows: *Males:* wing, 2.26–2.42 in., averaging 2.35; tail, 1.32–150, averaging 1.41; exposed culmen, .49–.51, averaging .50. *Females:* wing, 2.10–2.27, averaging 2.17; tail, 1.14–1.38, averaging 1.26; exposed culmen, .46–.50, averaging .48.

**32. Procnias viridis** *Ill.**—This species is represented by a series of 59 specimens, all collected at Chapada, as follows: January, 3; February, 1; March, 3; July, 1; August, 24; September, 14; October, 7; November, 6. The period from March 26 to July 29 is unrepresented, during which time the species is probably absent from the vicinity of Chapada. Apparently every phase of plumage is represented, from the nestling to the adult. Of the 59 specimens 23 are fully adult males, 19 are adult females, and 28 are immature males in various phases of plumage.

The March specimens have apparently just completed a full molt, the outer primaries still retaining the sheaths at the base of the quills. No other adult shows signs of molting. A single nestling (labeled by the collector, ♂ juv., Nov., 1882) has the quills only about half grown, but the coloration is that of an adult female, showing that the first plumage is like that of the female. Young males of probably the second year are particolored, having usually more or less black on the throat, while the blue of the adult plumage is distributed in irregular patches. Sometimes the whole throat is black while the general plumage is still that of the female; again there may be very little or no black on the throat while the general plumage is strongly mixed with blue. At least two, and possibly three, molts take place before the males acquire their fully adult livery.

The females are slightly smaller than the males, as shown by the following measurements of ten specimens of each sex: *Males:*

* See this Bulletin, Vol. II, No. 2, p. 69, March, 1889.

wing, 3.37–3.70 in., averaging 3.56; tail, 2.25–2.33, averaging 2.30; exposed culmen, .35–.39, averaging .36. *Females:* wing, 3.34–3.60, averaging 3.46; tail, 2.05–2.38, averaging 2.24; exposed culmen, .36–.40, averaging .38.

**33. Euphonia chlorotica violaceicollis** (*Cab.*).—Represented by 81 specimens, collected as follows: January, 8; February, 13; March, 0; April, 5; May, 4; June, 2; July, 9; August, 20; September, 12; October, 7; November, 1; December, 0. The specimens taken from May to November, including both these months, are all in adult breeding plumage; of those taken in January, not one is a male in full breeding dress, 4 being males in transition plumage, and 4 females; of the February specimens one is an adult male, 9 are males in transition plumage, and 3 are females; of the 5 April specimens, 2 are adult males, 2 are young males just acquiring full dress, and one is a female. It would thus seem that birds of the year acquire full breeding dress at the second molt; it also looks very much as though the black and yellow livery was worn only during the breeding season. The males in transition plumage show that the molt begins in December, and is not fully completed till April; while a few have completed the molt as early as February, or even in January, others are molting as late as April.

In the adult males there is some variation in the depth of the yellow of the lower parts and the intensity of the violet-purplish sheen of the back and throat, due perhaps to age. In all the large blotch of white on the two external tail feathers is well developed, and there is generally a very narrow line of black at the base of the forehead, nearly as well marked in some examples as it is in *E. affinis* of Central America.

Unfortunately I have no specimens of the *E. chlorotica* group from other parts of South America for comparison with the present fine series from Chapada.

A series of 20 adult males measures as follows: wing, 2.14–2.34 in., averaging 2.20; tail, 1.15–1.36, averaging 1.24; exposed culmen, .28–.33, averaging .30. A series of 10 adult females gives the following: wing, 2.06–2.19, averaging 2.13; tail, 1.18–1.29, averaging 1.22; exposed culmen, .28–.33, averaging .30.

**34. Euphonia laniirostris** *Lafr. & d'Orb.* — Abrilongo, 4 specimens; Chapada, 29 specimens, taken as follows: February, 4; March, 3; April, 14; May, 3; June, 1; July, 1; August, 4; September, 1; December, 1. Of these three are fully adult males; one is a male (Feb. 1), with a few traces of the immature plumage still left; 13 are young males in the garb of the female, but showing traces of the adult livery, in the markings of the head; 10 are apparently females. The young males in transition plumage were collected in March, April, May, July, August and September.

The measurements of 6 adult males and 6 adult females are as follows: *Males:* wing, 2.44–2.57 in., averaging 2.50; tail, 1.34–1.50, averaging 1.37; exposed culmen, .36–.39, averaging .37. *Females:* wing, 2.28–2.46, averaging 2.34; tail, 1.23–1.36, averaging 1.31; exposed culmen, .34–.38, averaging .35.

This species differs from *E. crassirostris* Scl., from northern South America, in being much larger, with the yellow of the lower parts a much deeper (orange) yellow, and the cap deeper yellow and larger. It has a shorter, more triangular, and very differently shaped bill. The two forms are apparently specifically distinct, although united by Messrs. Salvin and Godman (Biol. Centr.-Am., Aves, I, p. 262). Mr. Sclater, however, has since (Cat. Bds. Brit. Mus., XI, p. 77) called attention to the desirability of the comparison of further material "before the absolute accuracy of this proceeding can be substantiated." Our material shows that Mr. Sclater's suspicion that the two forms might prove distinct was well founded.

**35. Pipræidea melanonota** (*Vieill.*).—Two specimens, both females, June 2, 1882, and July 21, 1883. Apparently a rare bird at Chapada.

### 36. Calliste margaritæ, sp. nov.

*Male Adult.*—Above similar to *C. cayana;* below similar to *C. flava.* Cap shining coppery rufous; rest of upper surface shining ochraceous rufous; wings and tail blackish edged with bluish green; sides of head, chin, throat, breast, and middle of belly black; rest of lower surface strong ochraceous rufous, much deeper than the color of the back. Bill blackish brown, lower mandible much lighter than the upper; feet blackish. Wing, 2.93; tail, 2.06; bill, .43.

*Female Adult.*—Cap deep ochraceous; rest of upper surface pale green with a yellowish sheen, the rump more fulvous than the back; wings and tail blackish edged with bluish green; sides of head, chin, throat, and breast dull greenish gray with a slight wash of yellowish; flanks and crissum ochraceous, deepest on the latter.

As already stated, this species curiously combines the characters of *C. cayana*, which it almost exactly resembles in the dorsal plumage, with those of *C. flava*, from which it is indistinguishable when seen from below.

Named in honor of Mrs. H. H. Smith, to whose untiring energy in the field we are largely indebted for the immense series of Chapada birds forming the subject of the present paper.

This species, fortunately, is represented by a series of 137 skins, showing the changes of plumage due to sex, age, and season, and also by well-identified eggs. The series of skins includes 50 males in adult plumage, 30 young males in various intermediate phases of plumage, 56 adult females, and one young bird (Nov.) in first plumage. The record by months is as follows: January, 10, all in molt; February, 3, one (♂ juv., Feb. 5) only in molt; March, 8, none in molt; April, 35, none in molt; May, 18; June, 2; July, 4; August, 15; September, 12; October, 14; November, 10; December, 6. Three adult males, taken Dec. 6 and 12, are just beginning to molt.

Several of the October and November birds are accompanied by nests and eggs.

From this series it would appear (1) that there is only one molt, which begins early in December, is at its height in January, and is mostly finished before the end of February; (2) that males in transition plumage occur throughout the year, and that (3) consequently the adult male plumage is not acquired till at least the second year, and possibly not till the third, the young males presenting apparently two distinct phases of plumage; (4) that the breeding season is mainly limited to the months of October and November.

The single bird of the year ("Dec., 1882") resembles in a general way the adult female; it is, however, much lighter (dull buffy white faintly streaked with olive gray) on the throat and breast, with the whole top of the head only slightly more rufescent than

the back. In the next stage the young males are just intermediate between the female and the adult male: the throat and breast is more or less blackish, most of the feathers being black beneath the surface and heavily edged with gray, the black showing through more or less strongly in patches; the flanks are dull ochraceous olive; the top of the head is deep shining bronzy ochraceous, in strong contrast with the rest of the dorsal surface, which is pale shining yellowish fulvous, mixed with greenish, thus very different from the duller yellowish green of the female, or the deep clear fulvous yellow of the adult male. At a still more advanced stage the head and throat are as in the adult, but the back is more greenish, and the black extends only to the upper breast, where it is much obscured by greenish gray, while the lower breast and abdomen are simply dusky greenish gray. As these two stages are not sharply defined it is impossible to say whether they result simply from individual variation or whether two years are required by the males to obtain the fully adult livery; the latter, however, seems the more probable.

The females also present two well-pronounced phases of plumage, both occurring throughout the year. In the first or younger stage the throat and breast are concolor,—dull olive gray with a slight buffy gloss, passing into olive buff on the flanks and lower breast, ochraceous on the middle of the abdomen, and brownish ochraceous on the crissum; above bronzy green with a faint sheen of fulvous; cap dull ochraceous brown with a greenish lustre. In the second or older stage the throat approaches a dull bluish green gray with faint indications of blackish shaft streaks; the lower breast is darker than in the first stage, and the rest of the lower surface less ochraceous; above the plumage is bluish green with a strong sheen of fulvous, and the cap is deep ochraceous rufous.

Fully adult birds, 10 males and 10 females taken at random, measure as follows: *Males:* wing, 2.84–3.03 in., averaging 2.93; tail, 1.86–2.22, averaging 2.06; exposed culmen, .42–.46, averaging .43. *Females:* wing, 2.70–2.90, averaging 2.80; tail, 1.92–2.17, averaging 2.02; exposed culmen, .41–.46, averaging .43.

This species is represented by three eggs—two of one set and one of another—taken with the parent birds respectively Oct. 28

and Nov. 29. The two taken on the latter date were much advanced in incubation and are more or less broken. One of them measures .85 x .53 in. The ground color is pale lavender, and the whole surface is thickly spotted all over with two shades of lilac brown, but most heavily over the larger end, where on one of them are a few larger spots of bistre. The third egg is perfect and measures .85 x .60, being much thicker in proportion to its length. It is also so heavily spotted that the whole surface is nearly covered with the markings, which are of a lighter and more reddish brown than in the other set.

**37. Tanagra sayaca** (*Linn.*) (= *T. sayaca* + *T. cyanoptera* auct.).—Represented by 132 specimens, taken as follows: January, 12; February, 11; March, 14; April, 23; May, 13; June, 6; July, 8; August, 10; September, 15; October, 13; November, 3; December, 2; without date, 2. Eggs accompany several of the October and November specimens. The molt appears to begin early in January and to continue into March.

The series presents quite a range of variation in color, which, according to the sexing of the specimens by the collector, is not closely correlated with either sex or season, but may depend upon age. Of the 132 specimens 60 are sexed ♂, and 64 ♀, 12 being unmarked for sex. When arranged according to sex, the two series present no appreciable difference in coloration. About one-half of either sex show no olive green in the plumage, either above or below; nearly another half present an olive green shade throughout most of the upper plumage (strongest on the rump), and a strong wash of the same tint across the breast, along the flanks, and over the crissum. A much smaller proportion, about one-fourth of the whole, are variously intermediate, obviously in many cases in a transition stage between the two phases. Several of the green birds appear to be unquestionably birds of the year, and the transition from the green to the blue phase seems clearly due to age, the blue birds being fully adult, the green ones partly birds of the year and partly birds of the second year. As already intimated, both phases occur throughout the year.

The bluish gray birds are indistinguishable from Bahia specimens (hence *T. sayaca* auct.), while the birds with a greenish tinge agree with the socalled *T. cyanoptera*. Unfortunately I

have not a large series of birds from eastern Brazil, which would prove of great importance in the present connection.

Measurements of a series of 40 specimens—10 adult males, 10 adult females, 10 young males, and 10 young females—show that the females average a very little smaller than the males, and that the young are smaller than the adults, in this case the young birds being apparently birds of the second year, before the molt, while the adults are all in very high plumage and presumably three years or more old. These measurements may be summarized as follows:

| | Wing. | Tail. | Exposed Culmen. |
|---|---|---|---|
| 10 ♂ ad. | (3.54–3.70)=3.60 | (2.42–2.68)=2.50 | (.48–.57)=.53 |
| 10 ♀ ad. | (3.40–3.62)=3.50 | (2.43–2.58)=2.47 | (.48–.54)=.51 |
| 10 ♂ juv. | (3.32–3.62)=3.40 | (2.32–2.48)=2.41 | (.48–.54)=.51 |
| 10 ♀ juv. | (3.32–3.54)=3.38 | (2.26–2.51)=2.39 | (.47–.55)=.51 |

The collection contains three eggs of this species, belonging to two different sets, taken, with the parents, Oct. 7 and 17, 1882. They measure .90 x .64 in., .88 x .67, .96 x .67. The ground color is dull grayish white, profusely spotted with dots and blotches of drab brown, overlaid here and there, but particularly at the larger end, with sharp splashes and streaks of blackish brown.

**38. Tanagra palmarum** *Wied.*—Represented by 64 specimens, taken as follows: January, 7; February, 7; March, 3; April, 8; June, 4; July, 6; August, 6; September, 12; October, 6; the months of May, November, and December being unrepresented.

The variation in color in the present series is exactly parallel to that noted above in *T. sayaca.* Three distinct phases of plumage are represented, but they present no correlation with either sex or season. Of the 64 specimens 20 are in fully adult plumage, and consist of about an equal number of males and females, according to the sex marks on the labels. Of the remaining 44 specimens—consisting also of a nearly equal number of males and females—a few are evidently (from the texture and softness of the plumage) birds of the year, a few of which (January and February specimens) are molting into the second phase, which embraces nearly two-thirds of the whole series. The first plumage is nearly uniform dingy grayish brown, with a slight wash of dark olive

green. The second plumage is yellowish olive green below, and brownish olive green above, lighter and more yellowish on the lower back, and paler, bluish green on the anterior half of the top of the head, without any very distinct lustre anywhere. The adults are darker throughout, with a distinct purplish gloss over most of the body plumage, much stronger in some specimens than in others, with the head (especially the whole crown) light delicate green, which has a bluish cast on the lores and chin. The preceding phase grades into this by a direct molt, but also almost insensibly by individual variation. It thus seems evident that the birds showing a distinct purplish gloss are at least two years old, while those in highest plumage are doubtless still older. The majority of the birds in highest lustre are males, so that in fully mature birds the males appear to average brighter than the females.

Measurements of 20 specimens—5 adult males, 5 adult females, 5 young males, and 5 young females—show the males to be slightly larger than the females, and the young birds in second plumage to be considerably smaller than old birds in high plumage. The following is a summary of these measurements:

| | Wing. | Tail. | Exposed Culmen. |
|---|---|---|---|
| 5 ♂ ad. | (3.77–4.12)=3.95 | (2.75–3.10)=2.97 | (.50–.57)=.53 |
| 5 ♀ ad. | (3.69–3.94)=3.75 | (2.66–3.02)=2.86 | (.52–.57)=.53 |
| 5 ♂ juv. | (3.67–3.80)=3.72 | (2.60–2.96)=2.78 | |
| 5 ♀ juv. | (3.60–3.71)=3.65 | (2.61–2.92)=2.76 | |

**39. Ramphocœlus astrosericeus** *Lafr. & d'Orb.*—Represented by 111 specimens, of which 54 are adult males, 44 adult females, 10 young males in transition plumage, and 3 birds in first plumage (November specimens).

The different months of the year are represented as follows: January, 11; February, 6; March, 9; April, 10; May, 12; June, 2; July, 7; August, 16; September, 3; October, 14; November, 13; December, 21; without date, 4. The January and February and the earlier March specimens are in molt. Young males in transition, patchy plumage seem to occur throughout the year, specimens in this condition having been taken in January, May, August, October, and November. Three November specimens are in first plumage.

The birds in first plumage resemble in color very dull-colored females, but the plumage has the soft, fluffy character distinctive of newly-fledged birds. Males in adult plumage vary somewhat in brilliancy, and in the extension of the red upon the breast and head; in some it is confined to the upper breast, and that of the head does not pass below the nape; in others it covers the lower breast and even extends to the flanks, and above tinges a portion of the interscapulars. The females vary below from a dull somewhat yellowish brick red to a deep intense dark brick red, which color extends as a strong surface wash over the whole throat and back. These variations obviously depend upon age, and are closely parallel with those of *Tanagra sayaca* and *T. palmarum*.

Two eggs of this species, taken Nov. 6, 1882, measure .93 x .65 and .92 x .67. They are light blue, rather sparingly dotted and blotched with blackish brown, with a few paler spots of lavender, the markings more or less circular, some of them drop-shaped.

**40. Piranga saira** (*Spix*).—Represented by 40 specimens—16 adults males, 3 males in the livery of the female, 6 males in transition plumage, 13 adult females, 2 females in first plumage—taken as follows: January, 3; February, 1; March, 0; April, 1; May, 5; June, 1; July, 4; August, 2; September, 10; October, 1; November, 6; December, 6.

The species is rare, and this large series was obtained by special quest of the bird.

Young in first plumage are greenish gray above, narrowly streaked with dusky; below pale yellowish white, more broadly streaked with dusky. The young of both sexes molt in November and December into the plumage of the female. The next stage is a mixed transition plumage of red and green above and red and yellow below, the proportion of red and green or yellow feathers varying with the stage of the molt. The adult male livery is evidently not always fully acquired by a single molt, as shown by males taken in September in particolored plumage, with males in fully adult plumage and males still wholly in the dress of the female. The adult males do not apparently resume the livery of the female, as is the case with some of the North American species of the genus, as January adult males are molting from a worn, faded red plumage into a fresher, brighter red dress.

**41. Eucometis albicollis** (*Lafr. & d'Orb.*).—This species is represented by a series of 55 specimens, showing all phases of plumage from the young bird just from the nest to breeding adults. This series may be classified roughly as follows: adult males, 22; adult females, 15; young birds partly or wholly in first plumage, 3; more or less immature (in various conditions of plumage), 15. The various months of the year are represented as follows: January, 5 specimens; February, 4; March, 11; April, 2; May, 6; June, 1; July, 4; August, 2; September, 4; October, 1; November, 9; December, 6.

Mr. A. E. Smith informs me that this species is not of common occurrence at Chapada, and this large series is due to special efforts, the bird being sought for especially on account of its showy colors.

A young bird taken Dec. 1, still mostly in first plumage, is dull olive brown above with a tinge of ochraceous, including all the wing-coverts, the greater of which are broadly edged with ochraceous; quills dull olive green; below buffy ochraceous, lighter on the middle of the body and darker (browner) on the sides, the feathers of the breast centred slightly with dusky. In this specimen the greater part of the head has molted into a dull green, and dull green feathers are mixed through the interscapulium, while dull buffy yellow feathers are appearing on the throat and breast. A second specimen, taken Feb. 14, is rather more advanced in molt, but still retains much of the first plumage. A third specimen, though taken Jan. 3, is much more advanced than the last, while a fourth, taken Dec. 1, has nearly fully acquired the second plumage. Hence apparently the breeding season is considerably protracted, beginning early in October, and continuing till into November.

In the second plumage the head is deep yellowish green, like the rest of the dorsal surface; the throat and breast are pale greenish yellow, passing into deep yellow over the lower breast and the lower surface generally. At this stage the bill is black, instead of horn color above and light beneath as in adults.

The regular molt appears to extend over a long period, molting birds occurring from November till May. The adults appear to molt slowly and somewhat irregularly from November till Feb-

ruary, and the young birds (birds of the preceding year) from February to May. In newly-molted adults (January, February, and March specimens) the cap is pure cinereus; later in the season (April to November) the cap is olive brown gray, the crest often lightening to a lustrous pale fulvous gray. Apparently this last change takes place without a molt.

Birds of the year appear to molt later than adults, specimens molting from the yellow throat and green head of the second plumage into the buffy white throat and ashy gray head of the adult occurring only from February to May (Feb. 21 to May 23), with the single exception of a specimen taken Dec. 21. In some specimens this change takes place most rapidly on the throat, in others on the head, so that specimens occur having only a few yellow feathers left in the throat while the head is still green flecked with gray, or the reverse, the head having become nearly all gray while the throat is still yellow flecked with white. At the same time a general molt, including wings and tail, is in progress.

From the material in hand there is apparently very little sexual difference in either color or size. The males average slightly larger, and seem to have the crest a little longer and fuller, with more of the silvery fulvous lustre. The full dress appears to be acquired the second year, or with the third molt.

In adults the length of the wing varies from 3.35 to 3.65 in., averaging 3.50; the length of the tail ranges from 3.20 to 3.50, averaging about 3.30.

### 42. Tachyphonus rufus (*Bodd.*).

*Tangara noir, d'Amerique*, DAUB. Pl. Enl. 179, fig. 2 (♂).

*Tangara albirostris* BODD. Tabl. Pl. Enl., 1783, p. 11 (*nec* LINN.), based on the above.

*Tangaroux, de Cayenne*, DAUB. Pl. Enl., 711 (♀).

*Tangara rufa* BODD. Tabl. Pl. Enl., 1783, p. 44.

"*Oriolus melaleucus* SPARRM. Mus. Carls. 1787, No. xxxi."

*Tachyphonus melaleucus* auct. recent.

The earliest name for the species of late commonly known as *Tachyphonus melaleucus* is *Tangara rufa* Bodd., based on Daubenton's plate as above cited.

This abundant species is represented by 148 specimens—100 ♂ ad., 40 ♀ ad., 2 ♂ juv., 6 juv. in first plumage—taken as

follows: January, 11; February, 5; March, 15; April, 14; May, 21; June, 13; July, 16; August, 15; September, 7; October, 12; November, 10; December, 9.

Young birds in first plumage (taken in November and December) are like the adult females in coloration, but the plumage is lax and soft. The only birds in particolored plumage are two males taken in March, one of which has acquired about half of the adult plumage, the other rather less. A few March, April, May, and October males also retain a few feathers of the immature plumage.

The molt extends from January to April, but is at its height in February; most March specimens, and nearly all taken in April are in perfect high plumage, but a few of the latter were still in molt.

Two sets of eggs, consisting respectively of two and three each, and taken Oct. 3 and 12, 1882, are brownish white with prominent isolated dots and streaks of bistre and brownish black, with finer half-concealed shell markings of pale lavender. The two sets measure as follows: (1) 1.02 x .68 in., 1.01 x .68; (2) .95 x .73, .94 x .74, .95 x .73. One of the labels gives the place of the nest as "In coffee tree, in garden, seven feet from ground."

**43. Cypsnagra ruficollis** (*Licht.*).—Represented by 57 specimens, of which 27 adults are sexed as males, 13 adults as females; 10 in immature plumage are marked males and 3 females, while 4 are unmarked for sex. The months of March, June, and October are unrepresented, the specimens having been taken as follows: in January, 7; February, 7; April, 2; May, 2; July, 4; August, 6; September, 7; November, 7; December, 8.

There is apparently no sexual difference in coloration or size. Freshly-molted adult birds are frequently tinged with buff below, and have more or less ashy bordering the feathers above; the buff gradually fades to soiled white and the ashy edgings wear away, leaving the black of the upper parts deep glossy black. Birds in immature plumage appear to occur throughout the year; in these the back is ashy brown more or less tinged with olive and streaked broadly with blackish; the lower parts are strongly washed with yellowish buff, and the throat is much paler rufous than in the adults. Others are dull brownish black above, patched with new

black feathers. Birds in these plumages are probably birds of the preceding year. Birds of the year (one specimen, Dec. 19) are similar, but with the plumage more fluffy and softer. The fully adult plumage appears to come in at the third molt.

**44. Nemosia pileata** (*Bodd.*).—Chapada, 2 specimens, ♂ ad., July 24, and ♀ ad., Aug. 4, 1883; Corumba, 4 specimens—♂ ad., Nov. 29, 1883; ♀ ad., Dec. 5, 1883; ♂ juv., April 4, 1886, and ♀ ad., April 8, 1886. The November specimen is in exceedingly worn plumage. The young male is faintly tinged on the throat with ochraceous, but much less so than in the females; the black area of the head in the adult male is mixed blackish and blue.

**45. Nemosia guira** (*Linn.*).—Of the 33 specimens of this species 16 are adult males, 13 adult females, and 2 young males in transition plumage. Each month of the year, except March, is represented by from 1 to 7 specimens.

Young males appear for a time to resemble the females. Males of the second year are in transition plumage. Thus a male, taken April 2, differs from the female in having the lower back reddish orange, but the patch is much more restricted and paler than in the adult male; the throat shows a mixture of black feathers, and the breast is mixed reddish orange and yellow. Another, taken July 20, is similar, but with more black on the throat and more orange on the breast.

**46. Thlypopsis sordida** (*Lafr. & d'Orb.*).—Represented by 19 specimens taken in January (3), May (1), June (3), July (1), August (2), September (3), October (3), and November (3); December, February, March, and April being unrepresented. No specimens were taken between Jan. 30 and May 26, during which period the species is probably absent at Chapada, and from the smallness of the series is probably at no time abundant. Of the 19 specimens 8 are sexed male, 7 female, 3 "♂?", and 1 "♀?". The series includes 5 young birds—4 males and 1 female—taken 1 in January, 3 in June, and 1 in October.

A freshly-molted January adult male is everywhere heavily washed below with brownish ochraceous, except on the throat, which is deep yellow, and the middle of the abdomen, which lightens to whitish. The other adults are pale ochraceous below,

strongest across the breast and on the flanks. A January ♂ juv. is deep olive green above, with a few orange red feathers appearing on the forehead; below, throat deep yellow, passing into paler yellow over the whole breast and middle of the abdomen, the flanks and crissum deep buff washed with yellow. A June "♂?" resembles the last, except that the colors are everywhere paler, and the back is mixed with the ashy brown feathers of the adult. An October male is like the June specimen, except that there is a large patch of orange red feathers on the top of the head, and scattered feathers of the same color over the hind head.

**47. Arremon polionotus** *Bon.*—The series of this species consists of 77 specimens—41 ♂ ad., 3 ♂ juv., 31 ♀ ad., and 2 ♀ juv.—and represents each month of the year, collected as follows: January, 3; February, 5; March, 6; April, 6; May, 8; June, 13; July, 2; August, 10; September, 7; October, 11; November, 5; December, 1.

In the fully adult male in high plumage the whole cap is black; in many males, however, apparently otherwise in fully adult plumage, the posterior border is divided by a broad ashy patch extending up from the nape; in some it barely reaches the crown; in others it reaches the middle of the crown, and in still others forms a well-defined median ashy stripe extending to the forehead, and even occasionally to the base of the bill. In these latter, however, there are generally a few greenish feathers scattered through the interscapulium, showing that such examples are comparatively young birds. The same tendency to a division of the crown by an ashy median band is traceable in many of the adult females.

This species is rare in collections, and the female has not as yet been well described.

*Male Adult.*—Above deep plumbeous; whole top and sides of the head and nape deep pure black, with the gray of the back dividing the black on the middle of the nape, and often extending forward to the top of the head, and occasionally to the base of the bill as a well-defined median stripe; superciliaries, beginning over the eye, white; wings and tail blackish, the feathers more or less edged with the color of the back; all of the external wing-coverts light olive green, becoming lighter or yellowish olive green on the lesser coverts; bend of the wing deep bright yellow; below pure white, with a narrow black pectoral

collar, and the flanks ashy; top of the upper mandible black, rest of the bill yellow.

*Adult Female.*—Above olivaceous brown, with generally a decided tinge of ashy; head brownish black, the cap usually divided by a median stripe of olivaceous ashy, sometimes wanting but generally present; superciliaries and pectoral band as in the male; wings and tail as in the male, but duller and browner; below, throat, breast, and sides of abdomen soiled buffy white; middle of abdomen nearly pure white, flanks pale brown. In young birds the buffy wash below deepens to pale olivaceous, and the back is more distinctly olivaceous.

Unfortunately there are no birds wholly in first plumage, but traces of it (or perhaps of the second) are seen in molting birds, taken in February, March, April, and May, in which are seen vestiges of a former plumage of dull greenish brown on the sides of the head and hind neck, and of bright olive green on the back.

The females are considerably smaller than the males, as indicated by the following measurements of 10 adults of each sex: *Males:* wing, 2.90–3.26 in., averaging 3.04; tail, 2.45–2.70, averaging 2.55; exposed culmen, .52–.58, averaging .54. *Females:* wing, 2.67–2.93, averaging 2.78; tail, 2.27–2.45, averaging 2.40; exposed culmen, .53–.62, averaging .57.

Two eggs of this species, taken with the parent bird Oct. 21, 1882, are much elongated in form, measuring .95 x .62 in. and 1.00 x .60. The ground color is creamy white, finely spotted with rusty brown, sparingly over the smaller end, thickly and heavily over the larger end, where the brown spotting nearly conceals the ground color. One of the eggs has shell markings of deep lavender brown.

**48. Arremon silens** (*Bodd.*).—The 8 specimens representing this species consist of 4 adults (3 ♂, 1 ♀) and 4 young birds in first plumage, taken as follows: January, 1 ("♂ juv."); February, 2 (♂ ad., ♀ ad.); March, 2 (♂ ad., "♀ juv."); June, 1 (♂ ad.); November, 2 ("♂ ? juv.," "♀ ? juv."). From this it would seem that the species breeds over a long period,—at least from October till April.

The youngest specimen (wings and tail not fully grown) was taken March 16. Above it is nearly uniform dull brownish olive green; below, the throat is whitish streaked with dull dark greenish brown; breast olive greenish brown, faintly streaked

with lighter; flanks brown washed with greenish; rest of lower parts dull whitish streaked with darker (olive brown tinged with yellowish). A second specimen (taken Nov. 22) is slightly older, but still similar with here and there the new bright feathers of a more advanced plumage coming in. A third (taken Jan. 1) is similar, but a little more advanced, the dark patches on the sides of the head being well outlined. The fourth (taken Nov. 30) is still further advanced in molt, changing into the garb of the adult female on the throat, breast, and head.

An adult male, taken March 31, has about two-thirds completed the regular molt.

### 49. Saltator maximus (*Müller*).

*Tangara, des grands Bois de Cayenne*, DAUB. Pl. Enl. 205.

*Tanagra maxima* MÜLLER, Syst. Nat. Suppl. 1776, p. 159. (Based on the above.)

*Tanagra magna* GMELIN, Syst. Nat., I, 1788, p. 890. (Based on Pl. Enl. 205.)

*Saltator magnus* BON. et auct. recent.

Of the 32 specimens representing this species 12 are adult males, 16 adult females, 2 young males, and 2 are not marked for sex. It is probably a resident species at Chapada, although the months of March and December are unrepresented in the series.

The sexes are apparently not externally distinguishable. The January specimens are beginning to molt; in the February specimens the molt is well advanced. Specimens in full plumage vary somewhat in the amount of cinereous on the head, it showing very little in some and in others extending across the occiput and showing through the thin veiling of green over nearly the whole top of the head.

Two young birds, taken respectively Nov. 30 and Feb. 28, are still partly in nestling plumage; the February example is, however, the younger of the two, showing that the breeding season covers a considerable period. Aside from the fluffy character of the first plumage, much of which is still retained, these birds differ from the adults in the much lighter color of the bill, and in a generally duller coloration. The green of the upper parts is a dark grass green instead of light yellowish green, as in the adults; the fulvous of the throat and crissum is also paler, and

the black stripes bordering the throat are narrower and less sharply defined.

None of the specimens presents even a trace of the black gorget distinctive of the nearly allied *S. magnoides*.

**50. Saltator similis** *Lafr. & d'Orb.*—This species is represented by 44 specimens—21 males and 23 females—all of which are in adult plumage except two. Each month of the year is represented, as follows: January, 1; February, 1; March, 5; April, 6; May, 3; June, 3; July, 4; August, 10; September, 5; October, 3; November, 2; December, 1.

The males and females are similar in coloration, but there is considerable seasonal variation, while the young are quite different from the adults. In all the lower back is cinereous, and the interscapulium, wing-coverts, and edges of the wing-quills are olive green, lightest on the quills; in adult birds the head and nape are nearly always more or less cinereous, sometimes with only a very slight wash of green, giving the effect of bluish green, but very few specimens have the head as pure gray as the rump; more frequently than otherwise the green prevails over the gray, and often almost wholly obscures the latter. This is particularly the case in freshly-molted birds, the green edging to the feathers wearing away and exposing the cinereous as the season advances. At the same time the strong buffy suffusion of the lower parts gradually fades to an obscure buffy gray.

Young birds differ from the adult in having the whole upper plumage, except the lower back and tail, dull olive green, and the lower plumage fulvous, the feathers of the upper breast broadly centred with dusky and washed with green, and those of the lower breast with prominent dusky shaft-stripes.

Eight eggs of this species represent parts of three different clutches, three of which were taken respectively Oct. 20, Nov. 10 and Dec. 4, 1882. The eggs are pale blue, with a narrow wreath of black, zizzag, variously interwoven lines, like narrow light pen strokes, mixed here and there with a heavier stroke. The eggs vary somewhat in form and size, the extremes measuring as follows: .95 x .76 in., 1.05 x .78, 1.00 x .72. An entry by the collector on the back of one of the labels reads: "Nest on low shrub, three feet from the ground, in thick forest."

**51. Saltator atricollis** *Vieill.*—The series of 46 specimens contains birds taken in every month of the year, as follows: in January, 4; February, 4; March, 7; April, 4; May, 1; June, 2; July, 8; August, 3; September, 5; October, 4; November, 2; December, 2. Of the 40 adults, 19 are sexed as males, 18 as females, and 3 are not marked for sex; of the 6 young birds 2 are marked males and 4 females.

Apparently the sexes are alike in plumage. A young bird with the quills half grown (♀? juv., Dec. 19) has the upper plumage dull brown, slightly ochraceous on the rump, and with the greater coverts and quills edged with brownish ochraceous. Below the plumage is dull soiled grayish white, the breast narrowly streaked with dusky, the flanks buffy ochraceous, and the crissum ochraceous rufous. In the next plumage the dorsal surface is chocolate brown, darker and not grayish brown as in the adult, and the lower surface is strongly ochraceous, with a yellowish wash across the breast; the dark area of the throat, forehead, and sides of the head is blackish brown instead of black as in the adult. Other young specimens (collected November to February) are in a transition stage between this and the adult plumage, in which the dark area of the head is spotted with black, etc.

**52. Diucopis fasciata** (*Licht.*).—Judging by the material in hand, this is an abundant species at Chapada from October till February, and rare or casual during the remainder of the year. The 43 specimens were taken as follows: January, 4; February, 6; March, 0; April, 0; May, 1; June, 1; July, 1; August, 3; September, 1; October, 5; November, 5; December, 17. Of these 30—16 ♂ and 14 ♀—may be considered as in fully adult plumage, while 14 are young birds, representing various degrees of immaturity.

There is apparently no sexual difference in color, and little if any in size. The November and December adults are in faded, worn plumage, the brownish gray of the back strikingly contrasting with the pure cinereous of the August and September specimens. The molt appears to begin in some individuals in December, and is general in February. The single May specimen is in perfect, fresh plumage.

A single specimen in fluffy first plumage is brown (between hair brown and bistre) above, darker on the head and lighter on the lower back, the light wing-bar faintly indicated, and the ear-coverts scarcely darker than the top of the head; below ashy white, strongly tinged with pale yellowish olive over the throat, foreneck, and breast. The second plumage is similar but the colors are all stronger, the brown above being deeper in tone and varying in different specimens from olivaceous brown to olivaceous russet; below olive buff with a yellowish tinge over the middle of the ventral surface. The ear-coverts and the lesser and greater wing-coverts vary in different specimens from the general color of the upper surface to blackish. January specimens are molting from this phase into the adult plumage. Many of the adult (November and December) specimens retain traces of the second plumage, particularly above. The single June specimen (still in molt!) is in a transition plumage, about one-third of the plumage being adult and the remainder immature.

**53. Schistochlamys atra** (*Gmel.*).—Of the 51 specimens, 20 are adult males, 17 are adult females, 4 are young males, and 10 are young females. The series in immature plumage consists of birds in uniform olive green dress, and in various stages of transition from this to the fully adult. The different months of the year are represented as follows: January, 1; February, 3; March, 6; April, 11; May, 2; June, 1; July, 2; August, 7; September, 6; October, 1; November, 5; December, 2.

There is no specimen in first plumage, but five are in second plumage, taken as follows: March 5, April 6 (two); April 15, May 5, May 15, July 6. These are uniform dark olive green above, the feathers grayish beneath the surface, but the gray not usually showing unless the feathers are disarranged; below strong yellowish green, passing into greenish yellow on the middle of the abdomen; just below the surface the feathers are gray, which often shows through the more superficial green tint, particularly on the breast. One April specimen (♀, Apr. 29) shows little touches of black on the throat, where a part of the feathers have black bases, and the head is gray faintly washed with olive. An August specimen has the forehead, sides of the head, chin, and

upper throat about half black, with the rest of the plumage olive green, as in the series first described.

A second series of five specimens is in much worn green plumage, molting into the gray and black of the adult, in which the old and new feathers are mixed in varying proportions.

The series as a whole shows (1) that the yearling birds begin to molt in September and continue in molt till late in January; (2) that the olive plumage is worn for at least a year. Birds in adult plumage are in molt from November till late in February. Males and females are not, at any age, appreciable different in plumage.

Two eggs of this species, taken Sept. 22, 1882, measure 1.02 x .67 in., and .93 x .60. The yellowish white ground color is nearly covered with small more or less blended specks and dots of dark chocolate, quite covering the egg and deepening on the larger end so as to almost wholly conceal the ground color. The label states that the nest was "found on a low shrub close by running water in an open field."

**54. Guiraca cyanea** (*Linn.*).—Two females, Chapada, April 12, 1886, and August 8, 1882.

**55. Oryzoborus torridus** (*Scop.*).—Represented by 5 specimens—2 ♂ ad., 1 ♂ juv., 2 ♀ ad.—Chapada, March, June, July, and November.

**56. Oryzoborus maximiliani** *Cab.* — Three specimens, Chapada, May 17 and 22, 1883.

**57. Sporophila hypoleuca** (*Licht.*).—Two specimens, ♂ ad., Cachoeira, Jan. 29, 1886; ♀ ad., Corumba, March 1, 1886.

**58. Sporophila plumbea** (*Wied*). — Six specimens, 3 adult males and 3 adult females, taken one each in March, May, June, and September, and two in July.

**59. Sporophila melanocephala** (*Vieill.*).—Four specimens, Corumba, February and March, 1886—2 ♂ ad., 2 ♂ juv.

**60. Sporophila cærulescens** (*Bonn. & Vieill.*).—This apparently common species is represented by 34 specimens, of which 7 are adult males, and the rest young males and females. A few

of the young males were taken just as they were acquiring traces of the adult plumage, but the greater part are in a garb indistinguishable from that of the female.

**61. Sporophila gutturalis** (*Licht.*). — Represented by 12 specimens, only 3 of which are adult males. The months represented are April, May, July, August, and November. I find great difficulty in distinguishing young birds of this species from the young of *S. cærulescens*, a number of which are only provisionally referred.

**62. Sporophila lineola** (*Linn.*).—One specimen, an adult male, Cachoeira, Jan. 29, 1886.

**63. Volatinia jacarini** (*Linn.*).—The 14 specimens representing this species consist of 6 adult males, 5 young males in various stages of plumage, and 4 adult females, taken in February, March, April, August, September, and October.

In all the under wing-coverts are white. The Chapada specimens, being true *jacarini*, differ from *V. splendens* not only in color, as various writers have pointed out, but in being considerably larger than the latter as represented in Yucatan and Guatemala.

**64. Phonipara fuliginosa** (*Wied*).—Three specimens—1 ♂ ad., Nov. 14, 1882; 2 ♀ ad., July 29 and Aug. 31, 1885.

The female (apparently not before described) is grayish olive brown above, slightly grayer on the head and more olive on the rump; below olive gray, browner on the sides and lighter (whitish) on the middle of the abdomen. Hence the specimen from Pernambuco, mentioned by Mr. Sharpe (Cat. Bds. Brit. Mus., XII, p. 152) as probably an adult female of this species must, if a female, be referred to some other species.

**65. Paroaria capitata** (*Lafr. & d'Orb.*).—Corumba, February, March, and April, 1886, 10 specimens; Uacuryzal (50 miles north of Corumba), 3 specimens. Of these 13 specimens 6 are adult and 7 are young.

There is apparently no sexual difference in plumage. The young birds have the whole upper plumage blackish brown, including the wings and tail, except the head, which is of a much lighter coffee brown, forming a distinct hood; sides of the head,

chin, and sides of the throat, ochraceous, fading to buff on the throat; flanks and crissum tinged with buff. This is probably the first plumage, which is retained in part by most of the young birds of the present series, which are all in transition plumage. In most of them the brown quills of the wings and tail are being replaced by black ones; the back is partly black and partly brown; black feathers are coming in on the throat and red ones on the head. In all the bill is yellow or light yellowish brown, a little darker in the young birds than in the adult.

Contrary to my formerly expressed opinion (this Bulletin, II, p. 84), *P. capitata* is apparently quite distinct from *P. gularis*, of which the Museum has recently received a large series. On the other hand, *P. cervicalis* is evidently merely a subspecies of *P. gularis* (*cf.* l. c.).

### 66. Coryphospingus cucullata (*Müll.*).

*Moineau, de Cayenne*, DAUBEN. Pl. Enl. 181, fig. 1.

*Fringilla cucullata* MÜLLER, Syst. Nat. Suppl., 1766, p. 166. (Based on the above.)

*Passer cristatus* BODD. Tabl. Pl. Enl., 1783, p. 11. (Same as the above.)

*Fringilla cristata* GMEL. Syst. Nat., I, 1788, p. 926. (Same as the above.)

*Coryphospingus cristatus* CAB. et auct. recent.

This beautiful Finch is represented by a series of 73 specimens—53 adult males, 5 young males, and 25 adult females—taken as follows: January, 8; February, 0; March, 4; April, 2; May, 11; June, 3; July, 13; August, 9; September, 16; October, 7; November, 2; December, 5; without date, 3. Although the month of February is unrepresented, the species is probably a permanent resident at Chapada.

Young birds at first resemble the female, as shown by March specimens molting from the dress of the female into that of the adult male. In a young male taken in August the general plumage is intermediate between that of the female and adult male, while the crest shows brilliant red only on the basal half of the feathers, which is concealed unless the feathers are raised. This seems to indicate that the fully adult male plumage may not be acquired till after the third molt.

The molt covers the period from January to May, being at its height apparently in March. The plumage is in most perfect

condition from about the middle of May till into August, after which it becomes worn and somewhat duller.

Two eggs of this species, taken Dec. 5, 1882, are pale bluish white, thickly and rather evenly spotted, speckled and blotched with chestnut brown. They measure .85 x .63 in., and .83 x .62. The label gives the native name as "Joaõzinha."

### 67. Porphyriospiza cærulescens (*Wied*).

*Tanagra cærulescens* WIED, Beitr. Naturg. Bras., III, i, 1830, p. 541. (*Cf.* this Bulletin, Vol. II, pp. 140 and 225.)

This species, rare in collections, is represented by 35 specimens, taken as follows: January, 1; February, 2; March, 1; April, 2; May, 1; July, 7; August, 7; September, 7; October, 1; November, 2; December, 3. It is thus evidently resident at Chapada the whole year. The specimens include 20 adult males, 6 adult females, 2 young males of the year, and 7 young males of apparently the second year.

*Adult Male.*—The adult male in high plumage is deep dark blue, passing into lighter cobalt blue on the forehead, sides of the head, throat, foreneck, breast, rump, and lesser wing-coverts, purer and more intense on the latter. The feathers of the back are centered with darker below the surface, the dark centre becoming more distinct in the worn plumage at the close of the breeding season, while freshly-molted birds have the edges of the dorsal feathers edged, sometimes quite broadly, with rufous. Bill yellow, with the top of the upper mandible more or less brownish, varying to wholly yellow.

*Young Male*, in second year.—Above chestnut, with a bluish suffusion, passing into blue obscured by ashy brown on the rump, the feathers of the head and back narrowly centered with blackish; below blue, much paler than in the adult, with ashy edgings to the feathers, more brownish ashy on the flanks; lesser wing-coverts intense blue; bill as in the adult.

*Young Male*, in first year.—Above, including wing-coverts and inner secondaries, deep reddish chestnut, the feathers (except on the rump) centered with darker; below buffy brownish, much lighter on the middle of the abdomen, the feathers all narrowly streaked with blackish. Bill brown, lighter below.

*Adult Female.*—Above rusty brown, the feathers conspicuously centered with blackish; below grayish white, with a faint wash of pale buff, the feathers streaked narrowly with blackish.

The changes of plumage in this species appear to be nearly parallel with those in the North American *Passerina cyanea*.

[*December, 1891.*]

**68. Tiaris ornata** (*Wied*).—Represented by 14 specimens, 8 males and 6 females, all adult, taken as follows: February, 2; March, 1; June, 3; August, 5; November, 3. Doubtless a resident species, but not common.

The female (not mentioned by Sharpe, Cat. Bds. Brit. Mus., XII, p. 807) has been well described by Wied (Beitr. Naturg. Bras., III, p. 612).

**69. Poospiza cinerea** *Bon.*—Two specimens, adult males, Chapada, August 5 and 9, 1882.

**70. Zonotrichia capensis** (*Müller*).—This, Mr. A. E. Smith informs me, is an abundant bird about Chapada throughout the year. It is represented in the present collection by a series of 25 specimens, of which seven are birds of the year, several of them taken before the quills were fully grown, and all of course in the well-known spotted plumage of the young.

One of the adult specimens is a beautiful albino, in nearly uniform pale creamy white plumage throughout, except that the black head markings of the normal plumage are distinctly patterned in pale dusky gray.

Adult birds—7 males and 5 females—measure as follows: *Males:* wing (2.50–2.58), 2.54; tail, (2.20–2.29), 2.25; culmen (.44–.50), .47. *Females:* wing (2.44–2.50), 2.47; tail (2.04–2.26), 2.16; culmen (.44–.48), .46.

Some 30 or more eggs of this species in the collection present a wide range of variation in size, form, and coloration, being quite as variable as the eggs of the North American Song Sparrow (*Melospiza fasciata*). The ground color varies from pale blue to nearly white. The markings, of some shade of reddish brown, may be evenly diffused over nearly the whole egg, or mainly crowded about the larger end, and either rather few, covering less than one-third of the ground color, or abundant, covering nearly the whole surface; they may be either all very fine or may form rather large blotches. Three eggs selected to show variation in size and form, measure .75 x .57 in., .95 x .64, and .85 x .63, the latter indicating about the average size and shape.

The earliest name for this species is admittedly *Fringilla capensis* Müller (Syst. Nat., Suppl., 1776, p. 165), based on Dauben-

ton's Pl. Enl. No. 386, fig. 2 ("Bruant, du Cap de Bonne-Espérance"), which is also the basis of Boddaert's *Emberiza pileata*, named in 1783. Owing to the habitat originally given being erroneous, Boddaert's name was not recognized as applying to the present species till the fact was brought to light by Mr. Sclater in 1855 (P. Z. S., 1855, p. 160), the species in the meantime having been renamed five times by as many different authors. Müller's still earlier name having, as already said, precisely the same basis, was not brought to notice till 1864, when attention was called to it—as to so many other overlooked names given by P. L. S. Müller in his now rather famous "Supplement" to his edition of Linne's "Systema Naturæ,"—by Mr. Cassin (Proc. Acad. Nat. Sci. Phila., 1864, p. 255). Müller's name has not been adopted owing to the hitherto prevailing prejudice against geographically erroneous names—a prejudice now, however, evidently becoming a relic of the past.

The habitat of this species, as commonly accepted, extends from Mexico southward throughout Central and South America. It, however, does not preserve a uniform character throughout this vast area, but evidently presents several strongly-marked geographical phases, for most of which there is an abundance of names already at hand. While my material is too limited to permit of a satisfactory study of this group, it clearly shows that three forms may be readily distinguished. As a preliminary step to this it is necessary to fix the original name *capensis* to some one of them. As it is most likely that the specimen figured by Daubenton came either from Brazil or Cayenne, the name *capensis* of Müller (or *pileata* of Boddaert, for those who object to Müller's name) may be assigned to the form of eastern South America. The three forms I propose to recognize will then stand as follows:

1. *Zonotrichia capensis* (Bodd.). Habitat, Guiana and Brazil, south to Argentine Republic. Synonyms, *Fringilla matutina* Licht., *Tanagra ruficollis* Spix, *Zonotrichia subtorquata* Swain.*

2. *Zonotrichia capensis chilensis* (Meyen). Habitat, coast region of western South America, eastward to Bolivia. This is a much larger bird than restricted

* *Zonotrichia subtorquata* Swainson was based on Spix, II, pl. 53, fig. 3, which is *Tanagra ruficollis* Spix and not *Tanagra graminea* Spix as Swainson inadvertently assumed! See foot-note to p. 288 of Vol. II of Swainson's "Natural History and Classification of Birds."

*capensis* (wing .30 to .50 inches longer in the average), with the gray of the head darker, and the black spots on the sides of the breast more or less joined to form an indistinct collar.

3. *Zonotrichia capensis costaricensis*, subsp. nov. Habitat, southern Mexico, Central America, and southward to Colombia (Bogota), and probably to Ecuador. About the size of restricted *capensis*, but much darker and more strongly colored, the black streaks on the back much broader, the black stripes on the sides of the crown and sides of the head greatly increased in width, as also the black spots on the sides of the upper breast, which are generally more or less united across the fore breast; the rufous nuchal collar is much deeper in color, and the breast and sides very much darker, and of a more grayish olive brown.

Type, No. 48,206, ♂ ad., San José, Costa Rica, Sept. 14, 1889; C. F. Underwood.—Bogota and Costa Rica examples are practically indistinguishable.

Young birds in first plumage of *Z. capensis* and *Z. c. costaricensis* are rather more different from each other than are the adults, as shown by a comparison of seven specimens from southwestern Brazil (Chapada) with two from Costa Rica and one from Bogota. Not only is the general coloration much deeper in *costaricensis*, but the dark streaks, both above and below, are much broader and blacker.

**71. Ammodramus manimbe** (*Licht.*).—A series of 44 specimens, representing every month of the year except February and December.

Two of the three birds of the year taken in January still retain the greater part of the first plumage, having the throat, breast, and flanks narrowly streaked with black, and the head uniform with the back,—not gray streaked with black as in the adult. The other is in second plumage, with the breast and flanks strong buffy brown, but unstreaked; the head is brown streaked with blackish.

The adults vary much, independently of season, in respect to the amount of rufous bordering the feathers of the back. This bordering is much more pronounced, however, in birds in fresh plumage (April to July) than later in the season (September to November), when the rufous bordering as a rule disappears.

Two eggs of this species, called "Tic-a-Tic do Campo," taken Nov. 11, 1882, are white, with a delicate wreath of small spots of blackish brown and purplish lavender around the larger end. They measure .77 x .56 in. and .65 x .55. Another set of two eggs, very much incubated and in bad condition, are similar, except that the markings are heavier and much more conspicuous.

**72. Emberizoides macrourus herbicola** (*Vieill.*).—A series of 16 specimens, representing the months of March, April, June, July, August, September, October, and December, but taken principally during the months of August, September, and December.

Females are somewhat smaller than the males but otherwise not externally distinguishable. Different specimens vary considerably in the amount of olive yellow suffusing the plumage of the upper surface, and in the amount of buffy brown on the lower parts. Two specimens show blackish shaft-stripes on the lower tail-coverts; a December female is deep olive-yellow brown below. These variations are not correlated with either sex or season, but are probably due to age.

**73. Coryphospiza melanotis** (*Temm.*).—Two adult males, February and April, 1883; one adult female, July 8, 1883.

The female (apparently not previously described) has the head brown broadly streaked with rufous, the centres of the feathers black, and thus concolor with the back. Below throat and breast more buffy than in the male, with the feathers of the breast centered with narrow, and those of the flanks with broad dark reddish brown shaft-streaks. The bill is wholly reddish brown, instead of black above and yellow below, as in the male. There is a narrow yellowish white superciliary stripe, but there is no black on the head and no gray on the hind-head and nape, as in the male.

**74. Spinus yarrelli** (*Aud.*).—This species is represented by 5 specimens, 2 adult males, 2 young males, and 1 female, taken in May and July, 1883.

One of the young males is in nearly the garb of the female; the other is in transition plumage, with the throat and head patched with black.

**75. Sycalis pelzelni** *Scl.*—Two males, Cuyaba, Jan. 27, 1885.

**76. Sycalis arvensis** (*Kittl.*). CHUPACAPIM.—The series representing this species is exceptional in regard to season when the birds were obtained. Of the 80 specimens 37 were taken in the month of June, 1885, 7 in July, and 3 in August of the same year. Of the others 12 were taken in August, 1882, and 3 in

August, 1883, and the remaining 8 in September, 1882. The species is thus apparently a winter visitor of irregular occurrence. The September specimens—2 males and 6 females—are the only birds in breeding plumage. In these there is very little ashy to the feathers anywhere. August specimens show much less of it than do the June examples.

Ten males and ten females, taken at random, present the following measurements: *Males:* wing (2.80–2.96), 2.87 in.; tail (1.86–2.05), 1.97; culmen (.36–.40), .37. *Females:* wing (2.62–2.90), 2.77; tail (1.80–1.98), 1.91; culmen (.36–.40) .37.

**77. Ostinops decumanus** (*Pall.*). Japu.—A series of 40 specimens, nearly all taken at Chapada, represents each month of the year except March and June; the greater part, however, were taken during July, August, September, October, and November. Males and females are about equally represented, while one November specimen (taken Nov. 12) is a half-fledged young bird. In this the plumage is softer, and the coloration is a little less glossy than in the adults.

Many adult birds present here and there throughout the plumage single feathers either broadly tipped with pale yellow or wholly of this color. About one-half of the specimens show a few of these feathers, in some instances only two or three, while other specimens are conspicuously pied with them; one shows two bright yellow feathers in the chestnut of the lower back and one in the crissum, and many others on the breast, neck, back, and among the larger wing-coverts. It is evidently an abnormality analagous to albinism.

The sexual variation in size is shown by the following measurements of 10 adult males and 10 adult females: *Males:* wing (8.10–9.44), 8.51; tail (6.60–7.66), 6.98; culmen (2.02–2.36), 2.17. *Females:* wing (6.10–6.86), 6.54; tail (5.20–5.80), 5.43; culmen (1.56–1.74), 1.64.

Four eggs of this species, from probably as many nests, taken Nov. 6, 1882, present a very wide range of variation in color and size. One egg is clear white, with a few small rounded spots and one or two broad streaks of black near the larger end, and measures 1.40 x 1.00 in. Another is light blue, with a few black

markings scattered over the whole surface, and measures 1.40 x .93. A third has the ground color reddish creamy white, profusely marked with large blotches and finer spots of brownish lilac, varying to a darker brown; it measures 1.40 x 1.03. The fourth egg is similar, except that the markings are much less profuse, lilac mixed with dark bistre, and the ground color pale pinkish white. This is the smallest egg of the series, measuring only 1.25 x .90.

According to the labels the nests were at the ends of the branches in high trees. This species nests in large colonies with the Japuera (*Cassicus persicus*).

**78. Cassicus persicus** (*Linn.*). JAPUERA.—The 29 specimens representing this species were taken as follows: Abrilongo (near Chapada), February, 1883, 7 specimens; Chapada, June, 1885, 3 specimens; July, 1 specimen; September, 1; November, 12. Of the latter 5 are about half-grown young birds. The series consists of a nearly equal number of males and females.

The young birds are dull brownish black, with the yellow much paler than in the adults. Birds of the first year differ little in color from the nestlings; birds of the second year are in transition plumage,—dull-colored with irregular patches of the adult plumage.

The great sexual difference in size is shown by the following measurements of 8 adult males and 8 adult females: *Males:* wing (5.72–6.36), 6.03; tail (3.88–4.35), 4.08; culmen (1.21–1.32), 1.24. *Females:* wing (4.62–5.07), 4.86; tail (3.22–3.50), 3.36; culmen (1.02–1.12), 1.06.

Eight eggs of this species, taken Nov. 8 and 9, 1882, present much variation in size, shape, and color. Three, selected to show extremes of variation in size and form, measure 1.22 x .70, 1.18 x .75, and 1.07 x .74. The eggs are elongated and pointed, white, sprinkled with specks and small shell-markings of pinkish lavender, with superficial markings of sepia and blackish brown. The spots are usually wreathed about the larger end, but in one egg they are massed about the extreme tip of the small end, leaving the larger end plain white.

The descriptions of the nests written on the back of the collector's labels state that they were suspended from the ends of

the highest limbs of a tall tree in a clearing, the nest placed at a height of about 50 feet from the ground. On the same tree were about 50 nests, partly of this species and partly of *Ostinops decumanus.* The nests were oval in shape, built of grass, and about 14 inches in length.

**79. Icterus pyrrhopterus** (*Vieill.*).—Corumba, March 2 to April 15, 1886,—10 specimens; Piedra Blanca, Bolivia, April 21, 1886,—1 specimen; Albrilongo, February 20 and March 2,—2 specimens; Chapada, January 17 and 18, March 23, and July 22, 1883,—5 specimens; total, 18 specimens.

The March specimens were all in molt when taken, and include several birds in immature plumage. In one of these the greater coverts are tipped with white, the median covers yellowish white tinged with brown, and the lesser coverts pale chestnut. The inner wing-coverts are yellowish white, spotted with black, the wings brownish black instead of deep black as in the adult.

**80. Icterus croconotus** (*Wagl.*).—Two specimens,—♂ ad., Uacuryzal, Rio Paraguay, Feb. 14, 1886; juv., Cachoeira, Jan. 31, 1886.

The specimen in immature plumage is evidently a bird of the year, mainly in first plumage. It agrees with the adult in the pattern of coloration, except that there is a broad band of black across the middle of the interscapulium, and the lesser wing-coverts are black instead of orange. The clothing plumage is loose and fluffy, like that of a young bird in first plumage, except where a few new feathers are coming in, which are of a firmer texture. The black is everywhere dull brownish black; the yellow nearly pure yellow, except where the new feathers have come in, which latter are deep orange yellow, while the lower back and rump are tawny brownish yellow.

There is obviously a tendency, in adult birds of this species, to a very narrow black band across the interscapulium; sometimes it consists of a broken line consisting of a narrow black edging to a part of the feathers only; in others (probably birds of the second year) it forms a continuous well-defined black bar half an inch wide, while in the young bird above noted it is fully an inch in width. The lesser wing-coverts are at first black; in birds of

the second year they are pure deep yellow; in older birds orange yellow, varying to deep firey orange in birds in high plumage.

**81. Amblycercus solitarius** (*Vieill.*) — Three specimens, Corumba, April 7, and Piedra Blanca, April 20, 1886.

**82. Dolychonyx oryzivorus** (*Linn.*).—One specimen, Corumba, March 1, 1886,—an adult male in molt. (*Cf.* Chapman, Auk, VIII, 1890, pp. 43 and 122.)

**83. Agelaius cyanopus** *Vieill.* — Corumba, 5 specimens, March and April, 1886; Cachoeira, 1 specimen, Jan. 3, 1885.

Of these 6 specimens one only is an adult male, two are adult females, and three are young males, one of which is still in the garb of the female, while the other two are in particolored plumage, having about half molted into the livery of the adult male.

**84. Aphobus chopi** (*Vieill.*).—The 18 specimens representing this species were taken at Chapada during the months of May to December inclusive.

A single bird in first plumage (the quills about half grown, taken Nov. 10, 1883) is everywhere dull brownish black, in strong contrast with the deep shining black of the adult plumage.

These specimens are all referable to the true *A. chopi*, as distinguished by Leverkühn (Journ. für Orn., 1889, p. 104) from his *A. megistus*, as shown by the following measurements of 17 adult specimens, 10 males and 7 females: *Males:* wing (4.50–4.82), 4.62 in.; tail (3.20–3.54), 3.41; culmen (.84–.91), .88. *Females:* wing (4.24–4.54), 4.47; tail (3.02–3.42), 3.29; culmen (.84–.92) .87.

According to Leverkühn (l. c.), *A. megistus* measures: wing, ♀ 5.37, ♂ 5.67; tail, ♀ 3.94, ♂ 4.14; culmen, ♀ 1.00, ♂ 1.05.

**85. Cyanacorax chrysops** (*Vieill.*).—Corumba, 5 specimens, 4 of them taken Feb. 25 and 26, the other April 8, 1886.

**86. Cyanocorax cyanomelas** (*Vieill.*).—Represented by 8 specimens, taken as follows: May 23, 1; June 5, 1; September, 1; October, 1; November, 3; without date, 1.

A young bird in first plumage, with the quills not fully grown (taken Nov. 28) has the plumage loose and soft, but in coloration differs very little from adult birds, the head and whole lower parts being a little duller and browner.

The May and June specimens, being in fresh plumage, are much brighter colored than those taken in October and November, which present a bleached appearance throughout, but especially above, the back being ashy brown through the loss of the purplish tint of the fresh plumage.

These specimens are provisionally referred as above, as the only specimens of the *cyanomelas* group I have for comparison are two from Yungas, Bolivia, collected by Dr. Rusby, which I formerly referred (this Bulletin, II, p. 85) to *C. chilensis* (Sharpe ex Bonaparte),—presumably equal to *C. nigriceps* Sclater and Salvin (P. Z. S., 1876, p. 354), based on a Yungas specimen. The Chapada and Yungas specimens are certainly indistinguishable in color, but the latter are the larger. If *C. nigriceps* is different from *C. cyanomelas*, the present series is apparently referable to the latter, of which *C. nigriceps* is probably only a geographical form.

Six adult Chapada specimens measure as follows: wing (6.80–7.44), 7.13 in.; tail (6.08–6.50), 6.20; culmen (1.18–1.30), 1.25. Four of these specimens are sexed as males, one as a female, and the other is not marked for sex. The two Yungas specimens measure as follows: wing (7.50–7.74), 7.62; tail (6.56–6.76), 6.66; culmen (1.16–1.18), 1.17. The Yungas birds are thus larger, with, at the same time, a smaller bill.

**87. Uroleuca cyanoleuca** (*Wied*).—The 17 specimens representing this species were taken as follows: January, 1; April, 2; May, 1; June, 1; July, 5; August, 2; October, 1; November, 4.

The April–June specimens are brighter and much more richly colored than the October and November ones, the former being in fresh plumage, the latter in worn post-breeding condition.

Three eggs of this species, taken with the parent birds Nov. 21, 1882, are very uniform in size and color. The ground color is light pale blue, and the whole surface is covered thickly with dots and fine streaks of light and dark sepia, which are heavier and larger around the larger end, giving the general effect of a light bluish egg thickly peppered with dark brown specks. The eggs measure as follows: 1.28 x .94, 1.32 x .93, 1.28 x .93.

(*To be continued.*)

ARTICLE XXV.—*Observations on some Cretaceous Fossils from the Beyrût District of Syria, in the Collection of the American Museum of Natural History, with Descriptions of some New Species.* By R. P. WHITFIELD.

Much interest has been taken, from time to time, by many persons, in the fossil organic remains obtained from that portion of Syria embraced in Palestine and the Lebanon district; and although much has been written on the geology of this region, and several valuable memoirs on its fossil remains published, still much doubt remains in regard to the exact geological equivalency of the strata of the region. Consequently, any help that can be afforded, or light thrown upon the organic remains of these strata, is quite desirable. Very recently (1890) Dr. Max Blanckenhorn has published a very valuable memoir, "Beitrage zur Geologie Syrien," Cassel, in which he has worked over the palæontological writings of previous authors in this field (Conrad, Lartet, Frass, Noetling, Hamlin, etc.), and has figured and described some new and some previously-described species. When the announcement of Dr. Blanckenhorn's paper was first made, I was at work on a collection of Molluscan remains (Lamellibranchiates and Gasteropods) from the Beyrût district, obtained from the Rev. Dr. William Bird, of the American Board of Commissioners for Foreign Missions, located at Abeih. Part of the collection was originally sent to this country for the use of Dr. P. E. Hamlin, who published a memoir (Mem. Mus. Comp. Zoöl., Cambridge, Mass., 1884, Vol. X) on a previous lot, obtained partly from the same source and partly from the Rev. Selah Merrill, D.D. This later collection, unfortunately, did not reach Cambridge until after Dr. Hamlin's death; and, after remaining some years in storage, was purchased by this Museum. Subsequently, a second lot was obtained from Dr. Bird by myself; and it is upon these combined collections that the following remarks are based, and from which the new species are obtained. It will at once be seen that this collection has furnished a large number of new forms; but it by no means exhausts the Molluscan fauna of the region in these two classes of organisms, for I have still

quite a number of species represented by specimens that are not sufficiently well preserved for description and illustration.

It will not be necessary to enter into an elaborate or extended discussion of the geological relations of the various beds from which these fossils were obtained. This has already been done to some extent by Dr. Hamlin in his memoir, but much more elaborately by Louis Lartet, Geologist to the Geol. Exp. of the Dead Sea by the Duc de Luynes in 1864, published in the Ann. des Sci. Geologiques for 1869 and 1872; also by Prof. Frass, of Stuttgart, in his "Aus dem Orient," part I and II; by Prof. Dames, Dr. Noetling and several other authors, as well as what was previously given in the Official Report on the United States Exploration of the Dead Sea and River Jordan, under Lieutenant W. F. Lynch, Baltimore, 1852, and more recently by Dr. Max Blanckenhorn in the work above referred to. It will only be necessary to state that the prevailing opinion of all the later writers is, that the formation from which these fossils are obtained is Cretaceous and not largely Jurassic as supposed, and stated by T. A. Conrad in his report given in the Lynch expedition.

It will be necessary, however, for me to make remarks on many of the species, as I am convinced that many of those originally described by Mr. Conrad have been misunderstood, and others redescribed by subsequent writers under new names. Mr. Conrad's material was very poor, as well as of very limited extent. He, however, was not to blame for that. Many of his species were undoubtedly described from single individuals, and those in the poorest state of preservation for determination, namely, that of internal casts,* collected from the surface, after much weathering, and very imperfect, then poorly illustrated and poorly described. Still, as they stand as accepted species in catalogues, it is well to verify them as far as possible and to retain the names for those species to which they were originally applied. Among the collections obtained from Dr. Bird I have been able to identify many of Conrad's species, and following I

* Severe criticism has often been made as well as censure applied to persons for describing species based entirely upon internal casts of fossils, such as many of these here used. But if such critics will consider that by far the greatest number of localities of Cretaceous fossils the world over furnish only casts of most groups of organic remains, and that we must have some means of comparing and identifying these organic bodies, they will recognize that their criticisms and censure are uncalled for.

give a list of all those which I recognize which have been described up to the present time, including also those here described for the first time. They are also tabulated so as to show from which bed they are derived, giving their relative geological horizon. The localities are those given by Dr. Bird, and the following table of horizons of localities is also from his dictation. There are six distinct beds of Cretaceous rocks within the geographical limits covered by these fossils, the lowest of which is above the zone of the *Cidarites glandarius*, Lang., below which comes the Jurassic beds of Mejdel es Shems. These are as follows, with their localities as used in the following pages, beginning with the upper:*

No. 6. *Chalk.* Andrafil; Scweifat; Hawkil; Besaba.

No. 5. *Gazelle Mt. Cherts.* Gazelle Mt.; Gurzûz; East of Matully; Zachalta, between Matully and Gureefy.

No. 4. *Naaman Clay-limestones.* Ruiset Naaman; Bhamdûn.

No. 3. *Brown Clay, Gasteropod Clays, &c.* Between Shimlan and Aitath; Muktara; Ain Kesûr; Abeih; Bhamdûn.

No. 2. *Bewerty Beds, Nerinea Clays.* Bewerty; Marahh; Kurkafy; Ain Anûb; Gazelle summit.

No. 1. *Abeih Sandstone.* Abeih; Duccûn, Olive locality; Klelay; Andrifil.

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* I have made every reasonable effort to find the originals of Mr. T. A. Conrad's species described in the Official Rept. of the U. S. Exped. to the Dead Sea and River Jordan, under Lieut. W. F. Lynch, for the purpose of identification and comparison, as well as verification; they seem, however, to have been entirely lost sight of, as inquiries of the different societies and persons having charge of collections, where they might have been deposited, have entirely failed to bring any of them to light.

LIST OF ALL THE DETERMINABLE CRETACEOUS SPECIES OF MOLLUSCAN FOSSILS RECOGNIZED IN THE SYRIAN COLLECTIONS OF THE AMERICAN MUSEUM OF NATURAL HISTORY.

| LAMELLIBRANCHIATES. | 1 | 2 | 3 | 4 | 5 | 6 | |
|---|---|---|---|---|---|---|---|
| Ostræa succini, Frass. = O. alicula, Ham | × | | | | | | Olive loc. near Abeih. |
| O. (Exogyra) Menneti (Coq.), Lartet | | | | | —× | | Matully. |
| O. ( " ?) Dieneri, Blanck | × | | | | | | Olive loc. |
| Exogyra Africana (Lam.), Lartet | | | | | | × | Hawkil. |
| E " flabellata, D'Orb | | | | | | × | Andrifil and Besaba. |
| Gryphæa capuloides, Conrad | × | | | | | | Ain Anub and Abeih. |
| Pecten obrutus, Conrad | | × | | | | | Marahh. |
| Vola quinquecostata, Sow. sp | | | | × | | | Ruweiset Naaman. |
| Lima tenuitesta, W., n. sp | | | | | × | | Gazelle Mt. and Gurzûz. |
| Plagiostoma sp.? res. Lima rigida (Desh.), Goldf | ×+ | | | | | | Antura. |
| Radula Naamanensis, W | | | | × | | | Naaman. |
| Perna orientalis, Haml. | × | | | | | | Abeih, Kleelay, Olive. |
| P " Palestina, W | × | | | | | | Klelay. |
| Gervillia obesa, W | × | | | | | | Andrifil, below Chalk. |
| G " perobesa, W | × | | | | | | ½ m. from Abeih. |
| G " trepezoidalis, W | | × | | | | | Bewerty. |
| Pterinoperna Syriaca, W | | × | | | | | " |
| *Inoceramus Lynchi, Conrad | | | | × | | | R. Naaman. |
| Lithodomus stamineus, Conrad | | | | × | | | " |
| Trigonarca Palestina, W | × | | | | | | Olive loc. |
| Idonearca oviformis = *Arca oviformis*, Con | | | × | | | | Aitath (near). |
| I " Syriaca = *Arca Syriaca*, Con., and *A. orientalis*, C. | | | × | | | | Aitath and Ain Kesûr. |
| Arca longa, Conrad | | | | × | | | |
| A " brevifrons, Con. = *A. indurata*, Conrad | | | | × | | | R. Naaman. |
| Cucullæa parallela, Conrad | × | | | | | | Olive loc. |
| Pectunculus sp.? | × | | | | | | " |
| *Nucula crebrilineata*, Conrad. See Lucina crebrilineata | | | | | | | |
| *Nucula Mauritiana, Coquand? | | | | × | | | Naaman. |
| N " ? obtenta, Conrad, *probably a Tancredia* | | | | × | | | " |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *?Nucula *perobliqua*, Conrad | | × | | | | | Marahh. |
| N " submucronata, Conrad | | | × | | | | Bhamdun. |
| N " glanstriticea, W | × | | | | | | Olive. |
| *Trigonia Syriaca (Con.), Frass | × | | | | | | Duccûn. |
| T " cuneata, Conrad | | × | | | | | Marahh. |
| T " Lewisi, Blanck | | × | | | | | " |
| *T " pseudocrenulata, Noetling | × | | | | | | Duccûn. |
| *T " undulatocostata, Blanck | | —× | | | | | R. Naaman. |
| Cardita subrotundata, Conrad | | | × | | | | Aitath. |
| *C " lacunar, Hamlin | × | | | | | | Olive loc. |
| C " Rawsoni, W | | | ? | | | | Palestine. |
| Astarte engonata, Conrad | | | | × | | | R. Naaman. |
| A " lintea, Conrad | × | | | | | | Duccûn. |
| A " lucinoides, Conrad? | | | | | ×+ | | Gazelle Mt. |
| A " orientalis, Conrad | | × | | | | | Marahh. |
| Opis megambona, W | | × | | | | | Bewerty. |
| Platopis abrupta=*Nucula abrupta*, Conrad | × | | | | | | Duccûn. |
| P " obruta=*Opis obruta*, Conrad | | × | | | | | Bewerty. |
| P " plicata, W | × | | | | | | Abeih. |
| P " triangularis, W | × | × | | | | | Olive. |
| P " undata=*Opis undatus*, Conrad | | × | | | | | Marahh. |
| Eriphyla crenulicosta, W | | × | | | | | Bewerty. |
| Scambula secunda, W | × | | | | | | Olive loc. |
| *Lucina crebrilineata=*Nucula crebrilineata*, Con.? | × | | | | | | " |
| L " sp.? about 4 cm. in diameter=L. Safedensis, C.? | | | | | × | | Gazelle Mt. |
| L " percancellata, W | × | | | | | | Olive loc. |
| Tancredia Aleihensis=*Corbula Aleihensis*, Conrad | × | | | | | | Abeih. |
| Hippurites plicatus, Conrad=*H. Lewisi*, Frass | | | × | | | | Aitath. |
| H " liratus, Conrad | | | | | × | | Gazelle Mt. |
| Cardium (Protocardium) Hillanum, Sow | | | × | | | | Aitath and Shimlan. |
| *C " ( " ) bellum, Conrad | × | | | | | | Duccûn. |
| C " ( " ) Judiacum, Hamlin | × | | | | | | " |
| C " ( ?? ) Birdanum, W | × | | | | | | " |
| C " (Acanthocardium) crebriechinatum, Conrad | | | | × | | | R. Naaman. |

* See notes on these species.

| LAMELLIBRANCHIATES—*Continued.* | 1 | 2 | 3 | 4 | 5 | 6 | |
|---|---|---|---|---|---|---|---|
| Cardium (Serripes ?) Bewertensis, W | × | × | × | × | | | 1 Duccûn, 7 Bewerty, 2 Aitath, 2 Naaman. |
| Trapezium Naamanensis, W | | | | × | | | R. Naaman. |
| Veleda elliptica, W | × | | | | | | Olive loc. |
| Gonodon ? hebes, Hamlin | × | | | | | | Duccûn. |
| Corbicula (Batissa) Hamlini, W | × | × | | | | | Duccûn, Marahh. |
| Corbiculopsis Birdi, W | × | | | | | | Duccûn. |
| Dosinia Forgemolli= *Venus Forgemolli* (Coquand), Lartet | | × | | | | | Marahh. |
| Caryatis globulus, W | × | | | | | | Olive loc. |
| Callista Syriaca, W | | | | × | | | Naaman. |
| C " [Cyprina] Abeihensis, Hamlin | | | × | | | | Bet. Aitath and Shimlan. |
| Isocardia Merilli, Hamlin | | | | × | | | Naaman. |
| Cytherea indurata, Conrad | | | × | | | | Bet. Aitath and Shimlan. |
| C " Syriaca, Conrad | | | | × | | | " " |
| C " Libanotica, Frass | × | | | | | | Duccûn, Olive loc. |
| ? Tellina Syriaca, Conrad | | | | × | | | Naaman. |
| Arcopagia planissima, W | | | × | | | | Shimlan. |
| Donax minutissimus, W | × | | | | | | Olive loc. |
| Mactra Olivensis, W | × | | | | | | " |
| M " pervetus, Conrad | | | | × | | | Naaman. |
| Pholadomya decisa, Conrad | | | | | ×+ | | Ain Zchalta. |
| P " depacta, Hamlin | | | × | | | | Aitath and Bhamdun. |
| Cymella (Pholadomya ?) Vignesi (Lartet), Blanck | | | | | | × | Besaba. |
| Anatina orientalis, W | | | | | | × | Shweifat. |
| Corbula aligera, Hamlin | × | | | | | | Olive loc. |
| C " congesta, Conrad | | | × | | | | Bhamdun. |
| C " neæroides, Blanck | × | | | | | | Duccûn, Olive loc. |
| C " olivæ, W | × | | | | | | Olive loc. |
| C " sublineolata, Conrad | × | | | | | | " |
| Panopea pectorosa, Conrad | | | × | | | | Abeih. |
| P " didonis=*Mactra didonis*, Coq.? | | | × | | | | " |

GASTEROPODA.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fusus Bhamdunensis, Blanck | | | × | × ? | | | Bhamdun, Naaman ? |
| Caricella planilirata, W | | | × | | | | Bet. Shimlan and Aitath. |
| Volutomorpha orientalis, W | × | | | | | | Duccûn. |
| *Drillia pleurotomoides=*Aporrhais pleurotomoides*, Blanck | × | | | | | | Olive loc. |
| Mangelia solitaria, W | | | | | × | | Gazelle Mt. top. |
| Strombus Mermeti (Coquand), W | | | × | | | | Bet. Shimlan and Aitath. |
| S " (Melo) pervetus (Conrad), Ham | | | × | | | | " " |
| *Alaria monodactyla, Hamlin | | × | | × ? | | | Marahh, Naaman ? |
| Anchura petrosa, Con. sp.=*Cancellaria petrosa*, Con | × | | | | | | Olive loc. |
| Rostellaria (Anchura) Rustemi, Frass | | | | | × | | Gazelle Mt. |
| Natica? indurata, Con | | | | × | | | R. Naaman, Besaba, Ain Kesûr. |
| *N " ? scalaris, Con | | | × | | | | Ain Kesûr, Aitath. |
| Naticopsis ornata, Frass | × | | | | | | Duccûn. |
| Natica patuliformis, Frass | × | | | | | | " |
| Ampullina fluctuoides, W | × | × | | | | | Olive, Bewerty. |
| A " " var. acuminata, W | | | | | × | | Gazelle Mt. |
| A " minima, W | | | | | × | | Gazelle Mt. summit. |
| *Gyrodes orientalis=*Natica orientalis*, Conrad | | × | | | | | Marahh, Bewerty. |
| *Amauropsis Abeihensis, Hamlin | × | | | | | | Olive loc. |
| Neverita patula, W | × | | | | | | Duccûn. |
| *Vanikora*. See Fossarius | | | | | | | |
| Scalaria Bewertensis, W | | × | | | | | Bewerty. |
| S " novem-varicosa, W | × | | | | | | Olive loc. |
| Turritella Betmerensis, Blanck | | | | | × | | Gazelle Mt. summit. |
| T " Damesi, Blanck | × | | | | | | Olive loc. |
| T " [Mesalia] Kokeni, Blanck | × | | | | | | Duccûn. |
| *T " peralveata, Conrad | × | | | | | | Duccûn, olive loc. |
| T " Seetzeri, Lartet | × | | | | | | Olive loc. |
| T " Syriaca, Conrad | | | | | | | |
| Mesalia Abeihensis=*Glauconia Abeihensis*, Blancken | × | | | | | | Duccûn, Olive loc. |
| M " Gazellensis, W | | | | | × | | Gazelle Mt. summit. |
| Tubulostium rugosum, W | | × | | | | | Bewerty. |
| Chemnitzia Syriaca, Frass | | | | | × | | Gazelle Mt. summit. |

* See notes on these species.

| GASTEROPODA—*Continued.* | 1 | 2 | 3 | 4 | 5 | 6 | |
|---|---|---|---|---|---|---|---|
| Odostomopsis Abeihensis=*Phasianella Abeihensis*, Blacken. and=*Pyramidella amœna*, Blanck. | × | | | | | | Olive loc. |
| *Obeliscus bilineatus=*Cerethium bilineatum*, Conrad | × | × | | | | | Klelay, Bewerty, Gazelle Mt. summit? |
| *Nerinea Bhamdunensis, Conrad=*N. minima*, Blancken. | | | × | | | | Bhamdun. |
| N " Fleuriausa (D'Orb.), Frass | | × | | | | | Kurkify. |
| *N " cochleæformis, Conrad=*N. gammifera*, Lartet; *N. pauxilla*, Hamlin | | | | | × | | Gazelle (cherts). |
| *Nerinea cretacea, Conrad | | × | | | | | Bewerty. |
| *N " mammillæ, Frass | × | | | | | | Abeih, Duccûn, Ain Kisûr. |
| N " nobilis, Munster | | | | | × | | Gazelle chert bed, West of Dead Sea, Matully. |
| N " Scheckii, Frass | | × | | | | | Kurkify. |
| *N " Syriaca (Conrad), Blancken | | | | × | | | Bet. Shimlan and Aitath. |
| *Cryptoplocus Libanensis, Hamlin | × | | | | | | Klelay. |
| Fossarius neritopsoides=*Vanikora neritopsoides*, Blancken | × | | | | | | Olive loc. |
| *Cerithium magnicostatum, Conrad=*Turritella magnicostata*, Conrad | × | | | | × | | Duccûn, Abeih, Olive loc., Gazelle cherts. |
| Cerithium acuticostatum, Blancken | | × | | | | | Bewerty. |
| C " æquicostatum, Blancken | × | | | | | | Duccûn. |
| C " excavatum var. Syriacum, Blanck | × | | | | | | Olive loc. |
| C " Conradi, W | × | | | | | | Duccûn. |
| *Tympanotus orientalis=*Nerinea orientalis*, Conrad; *Cerithium Libanoticum* (Frass.), Blanck | × | | | | | | " |
| Potamides distortus, W | × | | | | | | " |
| Vertagus coloratus, W | × | | | | | | Olive loc. |
| Cerithiopsis cretacea, W | × | | | | | | " |
| Nerita Abeihensis, W | × | | | | | | " |
| N " bidens, W | × | | | | | | " |
| N " pogoda, W | × | | | | | | " |
| Neritopsis ornata, Frass | × | | | | | | Duccûn. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pileolus sphærulitum, Blancken | .... | .... | .... | .... | × | .. | Gazelle cherts. |
| Turbo Moreli, Frass | × | .... | .... | .... | .... | .... | Duccûn, Olive. |
| Trochus (Turcica) crispus, Blancken | . | .... | .... | .... | × | .. | Gazelle cherts, Gurzûz. |
| T " striætofundus, W | × | .... | . | .... | .. | .... | Olive loc. |
| Monodonta antiqua, W | .... | .... | .... | .... | × | .... | Gazelle cherts. |
| *Leptomaria simplex (D'Orb.), Frass.? | .... | .... | .... | × | .. | .... | R. Naaman. |
| Philine (Megistostoma) patula, W | × | .... | .... | .... | .... | .... | Duccûn. |
| *Actæonina vafra, Hamlin=*Natica olivæ* (Frass), Blanck | × | .... | .... | .... | .... | .... | Duccûn, Olive loc. |
| A " Syriaca, W | .... | × | .... | .... | × ? | .... | Klelay, Gazelle cherts ? |
| Actæonella Salomonis, Frass | .... | .... | .... | .... | × | .... | West of Dead Sea. |
| *Triptycha abbreviate=*Nerinea abbreviate*, Con.; *Actænella Absalonis*, Frass | .... | × | .... | .... | .... | ... | Bewerty. |
| Tornatella Abeihensis, W | × | .... | .... | .... | .... | .... | Olive loc. |
| *Colostracon Lewisi, Frass | × | .... | .... | .... | .... | .... | Duccûn. |
| *Tylostoma Birdana, Hamlin | × | .... | .. | .... | .... | .... | Olive loc., Duccûn. |
| T " depressa (Pictet & Camp), Hamlin | .... | .... | × | .... | .... | .... | Bet. Shimlan and Aitath. |
| T " gradata, Hamlin | × | .... | .... | .... | .... | .... | Duccûn. |
| *T " Syriaca=*Chenopus Syriaca*, Conrad | .... | .... | × | .... | .... | .... | Near Naaman, 6 m. E. Aitath. |
| T " indurata=*Chenopus induratus*, Con.; *Amauropsis subcanaliculata*, Hamlin | × | .... | .... | .... | .... | .... | Duccûn. |
| Tylostoma Gazellensis, W | .... | .... | .... | .... | × | .... | Gazelle Mt. summit. |
| T " triplica, W | .... | .... | .... | .... | × | .... | Gazelle cherts. |
| T " Martini, W | .... | .. . | .... | .... | × | .... | Gurzûz chert. |
| Globiconcha altispira, W | .... | .... | × | .... | .... | .... | Ain Kesûr. |
| Akera siliciosa, W | .... | .... | .... | ... | × | .... | Gazelle chert. |
| Dentalium cretaceum, Conrad | .... | .... | × | .... | .... | .... | Bhamdun. |

* See notes on these species.

# LAMELLIBRANCHIATA.

## SPONDYLIDÆ.

### Genus LIMA, *Brugiere.*

### **Lima tenuitesta,** n. sp.

PLATE 4 A, FIGS. 1 AND 2.

Shell of medium size, subovate in general form, and measuring about three and a half centimeters in length; valves moderately convex, extremely thin and fragile. Hinge line short, equal to two-fifths of the width of the body of the shell below, and entirely confined to the posterior side of the apex; area very distinct on each valve, the median depression quite distinct, nearly half the width of the area. Basal side vertical or overhanging, the umbonal ridge being sharply angular, posterior wing distinct and depressed. Surface marked by fine, low, flattened, bifurcating radii, strongest and most distinct near the posterior margin.

The species is a very marked one, and easily recognized from its extremely thin and delicate shell, as well as the fine bifurcating striæ. Much resembles *Lima undata* Desh. D'Orb., Pal. France, Vol. 3, Pl. 414, fig. 9, but the striæ are more than as fine again.

*Locality.*—In the Cherty layers at Gurzûz and Gazelle, near Abeih, Syria.

### Genus RADULA, *Klein.*

### **Radula Naamanensis,** n. sp.

PLATE 4 A, FIGS. 3 AND 4.

Shell small and very oblique, with ventricose valves, which are rather strongly radiated, radii numbering about eighteen or twenty. Hinge very short, the auriculations scarcely discernable from the upper side. Surface marked by very fine concentric striæ which cross the radii, but are barely seen by the unaided eye.

Several individuals of this species are present in the collections used, but all are in a rather poor state of preservation, still retaining all the external features of the shell. It is peculiar among its group from the great obliquity of the shell to the hinge, in

this feature being more extreme than any of the several American species of the genus. The specimens are usually about three-fourths of an inch (nearly two centimetres) in extreme length.

*Locality.*—In the clays at Naaman, N. E. of Abeih, Syria.

## AVICULIDÆ.

### Genus GERVILLIA, *De France.*

### **Gervillia obesa,** n. sp.

PLATE 4 A, FIGS. 5–7.

Shell below a medium size, moderately oblique, the axis of the shell having an angle of about 45° to the line of the hinge. Both valves quite ventricose, the left one most distinctly so, although the beak usually appears lower than that of the right one, owing to the form and twist of the valves. Hinge area moderately high, but very variable, being from about one mm. to three or even four on valves varying but slightly in size; crossed by four or five strong, deep, ligamental pits, none of which are found anterior to the beaks, while on the interior the hinge plate is marked by numerous fine oblique teeth, like those of *Pterinoperna*. Anterior wing large, full and ventricose, very distinctly separated from the body of the shell by a deep constriction; posterior wing usually rounding into the posterior margin of the shell, but occasionally being slightly pointed.

Surface of the shell strongly lamellose, and the left valve obscurely marked by a few indistinct radii along the umbonal ridge; that of the right valve only lamellose and more flattened on the umbo and umbonal ridge, and the anterior wing much more flattened. In an anterior profile view the valves show a decided twist toward the left hand from the hinge to the anterior constriction below, where they again curve to the right.

This will be readily distinguished from the two species of *Perna* described from this same region by Mr. Hamlin, in the Mem. Mus. Comp. Zoöl. by the presence of the anterior wing, which does not exist on either of those. It somewhat resembles *Pteroperna costatula* Lyc. sp. from the great Oolite of England, but is more robust, less oblique, with a rounder anterior and much shorter posterior wing.

*Locality.*—In beds equivalent to the Abeih sandstone at Andrafil, near Abeih, Syria.

### **Gervillia perobesa,** n. sp.

PLATE 5, FIGS. 6–8.

Shell moderately large, somewhat ponderous, and very ventricose, the left side being the larger and most inflated; beak prominent and slightly incurved, while that of the right side is appressed, and does not reach to the hinge margin. Hinge area high, about equal on each valve, and marked by three broad, deep ligamental pits, the distance between each greater than the width of the pits. Axis of the valves curved, at first forming an angle of about 60° with the hinge line, but later curving backward quite rapidly. Anterior wing comparatively small, inconspicuous; posterior wing not extended; posterior slope distinctly separated from the body of the shell on each valve, but most distinctly so on the left; posterior basal margin extended beyond the line of the wing margin in a rounded tongue-like projection. Surface of the shell strongly lamellose, and on the left valve along the body of the valve by four or more elevated radii. Of the type of *G. Renauxiana*, Math., as figured by D'Orb., Pal. France, Vol. 3, Pl. 398, but is more inequivalve and more arcuate.

Differs materially from the *G. obesa* above described in the much greater size; smaller anterior wing; curvature of the body, and less obliquity of the axis, and particularly in the less number of ligamental pits of the hinge area.

*Locality.*—In the Abeih sandstone, one and one-half miles from Abeih, Syria.

### **Gervillia trapezoidalis,** n. sp.

PLATE 4 A, FIGS. 11 AND 12.

Shell small, only right valves known, axis of the shell moderately oblique, body of the shell depressed-convex, triangularly trapezoidal in form, pointed at the beak, rapidly widening below and recurved at the postero-basal angle, distinctly separated from the wings by sharp constrictions; both wings depressed, the anterior one proportionally large, convex, protruding below the

hinge line, and very sharply divided from the body of the shell; posterior wing concave, much shorter than the body of the shell below, and the intermediate margin broadly concave. Hinge area moderate, marked by two or more oblique ligamental pits, and the inner surface of plate presenting a few vertical striæ-like teeth. Surface of the shell marked by lamellose lines of growth. No radii have been observed on this valve.

In general form this species somewhat resembles the right valve of *G. obesa* herein described, but differs in the smaller anterior wing, more decided posterior wing with its distinct line of demarcation between it and the body of the shell, which on one specimen gives the posterior umbonal ridge a distinct angulation; also in the triangular form of the body, and especially in the recurvature of the postero-basal portion.

*Locality.*—This shell has as yet been seen only in a light yellowish clay filled with *Nerinea*, at Bewerty, about three miles directly west of Abeih, Syria, and coming above the Abeih sandstone and brown clays. It is distinguished in the section as the Bewerty bed.

Genus PTERINOPERNA, *Morris & Lycette.*

**Pterinoperna Syriaca,** n. sp.

PLATE 4 A, FIGS. 13 AND 14.

A single left valve of this shell only has been observed. It is of moderate size and oblique, the body of the shell forming an angle of about 45° with the line of the hinge, and is depressed convex on the surface, with a distinct, pointed, but not incurved beak; the body rapidly widens below, the anterior margin being nearly vertical to the hinge; anterior wing narrow, pointed and depressed; posterior wing long, slender and deeply divided from the body of the shell, strongly marked on its surface by distant coarse, lamellose lines of growth, somewhat angular on the surface a little below the middle, representing the usual ridge characteristic of the posterior wings of this genus of shells. Disc of the shell marked by broad but rather obscure radii. The hinge area of this valve, externally, is narrow, and does not extend along the valve posteriorly far from the beak, but the inner hinge

plate is broad and well developed, and marked by numerous slender oblique teeth; those beneath the beak shorter and somewhat more vertical as well as more closely arranged than those on the posterior portion of the hinge.

*Locality.*—Found at Bewerty, about three miles west of Abeih, Syria, in the yellowish-brown clays.

### **Perna Palestina,** n. sp.

PLATE 4 A, FIGS. 8–10.

Shell of medium size or larger, having a vertical height from hinge line to base of 6½ cm., and a transverse diameter across the widest part of about 5 cm.; the thickness of the two valves together being 32 mm. Form erect, subovate, the hinge line at right angles to the axis of the body, and shorter than the width of the shell below. Valves subequal, the anterior side deeply indented and grooved by the byssal notch, but not open. Ligamental area moderately wide with ten ligamental grooves, which are slightly wider than the intervening spaces, and are deeply excavated. Surface of the shell smooth, with comparatively strong but very regular concentric lines of growth, which are scarcely lamellose, except on the anterior margin. The left valves shows evidence of obscure, distant, but broad radii on the middle portions of its area. Shell thick and dense.

This species differs from any of the other Syrian forms of the genus in being a somewhat larger species, in its greater proportional length and in its surface character and nearly equally convex valves.

*Locality.*—In the Abeih sandstone near the top, at Klelay, near Abeih, Syria.

**Inoceramus Lynchi,** *Conrad,* Off. Rept. Lynch's Expl. Dead Sea, p. 218, Pl. 8, fig. 47.

This shell has been referred to *Pholadomya ligeriensis*, D'Orb., both by Drs. Frass and Blanckenhorn. A number of specimens preserving the casts of both valves united are present in our collection, as well as casts of single valves. They are all from Naaman, Syria, from a clay bed which comes just above the

brown clays of the gasteropod bed and under the cherts of Gazelle Mt., or the Rudistes bed; and although they show no fragment of the shell, I think they are undoubtedly *Inocerami*, as they possess the straight posterior hinge line with other features of that genus, and all appear to have been somewhat inequivalve. They certainly do not present the features of *Pholadomya;* and, comparing them with d'Orbigny's figures of the above-named species, I can see no very close relationship. Consequently I have retained Mr. Conrad's name for it.

## ARCIDÆ.

### Genus TRIGONARCA, *Conrad.*

### **Trigonarca Palestina,** n. sp.

PLATE 5, FIGS. 1 AND 2.

Shell in the adult stage measuring 9 mm. in total length by 6 mm. high at the beaks, and having a thickness through the valves, at the fullest part of the umbonal ridge, of 5 mm. Form sub-trapezoidal, the beaks being large, prominent and situated more than one-third of the entire length from the anterior end; hinge line very short; posterior end prolonged, acutely pointed at the basal angle; basal line straight for more than two-thirds of the shell's length, from whence it rounds into the anterior end, which is somewhat sharply rounded; posterior cardinal slope nearly vertical, concave between the posterior margin of the shell and the acutely carinate umbonal ridge. Disc of the shell marked by rounded, radiating ridges, with interspaces on the anterior part of equal width; toward the posterior part the radii are more closely arranged; cardinal slope marked by curved radii, and the whole crossed by finer concentric ridges, which give a finely crenulated structure to the whole surface.

This shell is of the form and size of *T. cuneiformis*, Conrad (Pal. New Jersey, Vol. 1, Pl. 12, figs. 17 and 18, p. 88; Monog. IX, U. S. Geol. Surv.), but is less ventricose, not so cuneiform posteriorly, and has a shorter hinge line.

*Locality.*—Two individuals only, from the Abeih sandstone, at the olive locality near Abeih, Syria.

## NUCULIDÆ.

### Genus NUCULA, *Lamarck.*

**Nucula glanstriticea,** n. sp.

PLATE 5, FIGS. 3–5.

Shell almost minute, the largest one seen being scarcely 6 mm. long by 4 mm. high and thick; form subcylindrical and very ventricose; beaks small, terminal anteriorly, approximate; hinge line curved, extending almost to the posterior extremity, marked by about twelve highly elevated teeth on the posterior side and by five or six smaller ones on the anterior side of the beak; basal line arcuate, curving upward posteriorly; surface marked by fine, even concentric striæ; posterior adductor muscular scar quite deep, the anterior scar obscure.

This small shell has much the form of a grain of wheat, whence the name.

*Locality.*—In the Abeih sandstone at the olive locality near Abeih, Syria.

**Nucula crebrilineata,** *Conrad.*—Specimens which I have identified with this species, and which represent it very closely, are not *Nuculoid*, but would appear to be more nearly related to some group of *Lucina*, but a sufficient knowledge of their interiors cannot be obtained to be satisfactory.

**Nucula perobliqua,** *Conrad*, Offic. Rept. Lynch's Dead Sea Exp., Pl. 3, fig. 18.

The casts of this shell, as I have identified it, agrees exactly in all its characters with Conrad's figures and description, but when the shell is present it shows a distinct external ligament, and on one cast one can imagine a pallial sinus. On these evidences I have supposed it may have been a species of *Caryatis*.

## TRIGONIDÆ.

**Trigonia Syriaca,** *Conrad*, Off. Rept. Lynch's Dead Sea Expl., pp. 214, 232, Pl. 3, figs. 19–23, Pl. 4, Appendix, fig. 26.

This species has caused more confusion than any other shell in the series. Conrad included several forms originally under the

one name. The first figure which he gives, fig. 19 of Pl. 3, being the only one representing an adult specimen, and ought properly to be taken as the type of the species. An artificial cast made in an old pair of separated valves of *T. pseudocrenulata*, Notl., Zeitsch. der Deutsch. Geol., Gesel., 1886, p. 862, Pl. 25, fig. 5, gives precisely the outlines of Conrad's figure. Consequently I think that shell should retain the specific name *T. Syriaca*. With Conrad's *T. cuneiformis* I had identified that figured by both Noetling and Frass as *T. Syriaca*, basing my identification upon its general form and from an internal cast made as above-described in a pair of separated valves. A natural cast of this latter species (compressed) gives an almost exact copy of Dr. Blanckenhorn's figure of *T. regularicostata*. Since several authors unite in considering the form figured by Frass and Noetling as *T. Syriaca* it may be well to accept it, but, however, as Conrad's species. Conrad's figure 21 of Pl. 3, Off. Rept., if a *Trigonia* at all, is probably *T. undulatocostata*, Blanckenhorn. While his figure 26 of Pl. 4 App., is most likely a fragment of a large *Cardium Judiacum*, Hamlin.

**Trigonia undulatocostata,** *Blanck.*, Beitrage zur Geol. Syriens, p. 83, Pl. 5, fig. 5.

I have very good specimens of this species from the brown clays above the Abeih sandstone at Ruiesset Naaman, Syria. The shell is much prolonged posteriorly, with nearly anterior beaks, which are rather small and closely coiled. On the older specimen the undulations become obsolete along the base and posterior end. The height of the shell is to the thickness through the valves as six is to five; and the height and length nearly as two to three. In the interior the hinge teeth are large and finely corrugated on the sides.

## ASTARTIDÆ.

### Genus CARDITA, *Bruguiere.*

**Cardita Rawsoni,** n. sp.

PLATE 5, FIGS. 9 AND 10.

Shell attaining a medium size, very ventricose and rotund, with large, incurved, nearly anterior, beaks, which scarcely project

above the line of the posterior cardinal border; posterior end obliquely truncate, but not squarely so, the margin being somewhat rounded; basal line and anterior end regularly curved. Surface of the shell unknown, as only the casts have been seen, and they show no evidence or surface radii, indicating a very thickened shell, or a comparative finely radiated surface. The space between the beaks is very deep and wide, showing a much thickened hinge plate, and the markings left by the teeth are broad and strong.

The shell is so distinct in its short anterior end and inequilateral form from any of the species described from Syria, that I have not hesitated to describe it. Although the exact locality is not known, further than that it is from the Beyrût district. The specimens were received from A. L. Rawson, Esq., and present the lithological features of the brown beds above the Abeih sandstones.

Genus OPIS, *DeFrance.*

**Opis megambona,** n. sp.

PLATE 5, FIGS. 11 AND 12.

Shell below medium size, extremely ventricose, cordiform, with proportionally very large, very prominent, enrolled beaks, which stand up above the hinge line nearly or quite equal to one-third of the height from the hinge line to the base of the shell. Body of the shell below the beaks transversely ovate, widest posteriorly, the anterior end being narrowly rounded. Lunule very large and very deep, rounded at the bottom; escutcheon distinct, but not deep. Surface of the shell marked by numerous strong, elevated and rounded concentric ribs, with wider interspaces. Ribs strongest on the middle of the shell, becoming less distinct and indefinite at either end. Finer concentric striæ occur between the ribs.

I have not seen the hinge line of this shell, and only refer it to *Opis* from its large enrolled beaks, large lunule and depressed posterior cardinal area. The general form, except for the large beaks, would be that of *Astarte.* The posterior umbonal ridge appears to have been only moderately marked, and on most of

the examples is scarcely visible, though the specimens are all much distorted.

*Locality.*—In the clayey marls above the Abeih sandstone at Bewerty, near Abeih, Syria.

PLATOPIS, new genus.

Among the Lamellibranchiata shells from Syria are several species having similar characters, but which I can refer to no established genus. Two of these were described by T. A. Conrad in Lynch's Report, under the genus *Opis*, DeFrance, *O. undata* and *O. obruta*. A similar form has been described by Stoliczka in his Pal. Indica, Vol. 3, p. 296, Pl. 5, figs. 15–19, as *Crassatella*, *C. zitteliana*. Among the specimens in this collection are examples showing the hinge structure of three species, and partially that of two others; and show them to differ entirely from *Opis* in these parts, and more distinctly so from *Crassatella*. From the latter they differ in having the ligament external, and in the hinge teeth, and in being destitute of internal ligamental pit. From *Opis* they differ radically in the hinge structure; there being generally two diverging cardinal teeth in the right valve, with a single lateral groove on each side, while in the left valve there is usually one strong cardinal and no visible lateral, the edge of the shell fitting into the grooves of the opposite valve in such a way as to serve as teeth. From *Opisoma*, Stoliczka, they differ in having more cardinal teeth with the peculiar form of laterals on each side of the shell, instead of only on one side. Externally they somewhat resemble shells of the genus *Astarte* and also of *Nucula*, so much so that the cast of one of the Syrian shells was described by Conrad as *Nucula abrupta*, owing to a feature, which they all possess, of an abruptly truncated posterior slope, which in many is sharply flattened or even depressed between the umbonal angles, and the very ill-defined although large-sized lunule. The anterior margin of the shell is also smooth, not crenulated as in both *Opis* and *Crassatella*. For these species I propose the generic name *Platopis*, in reference to their flattened or depressed convex form as compared with *Opis* proper.

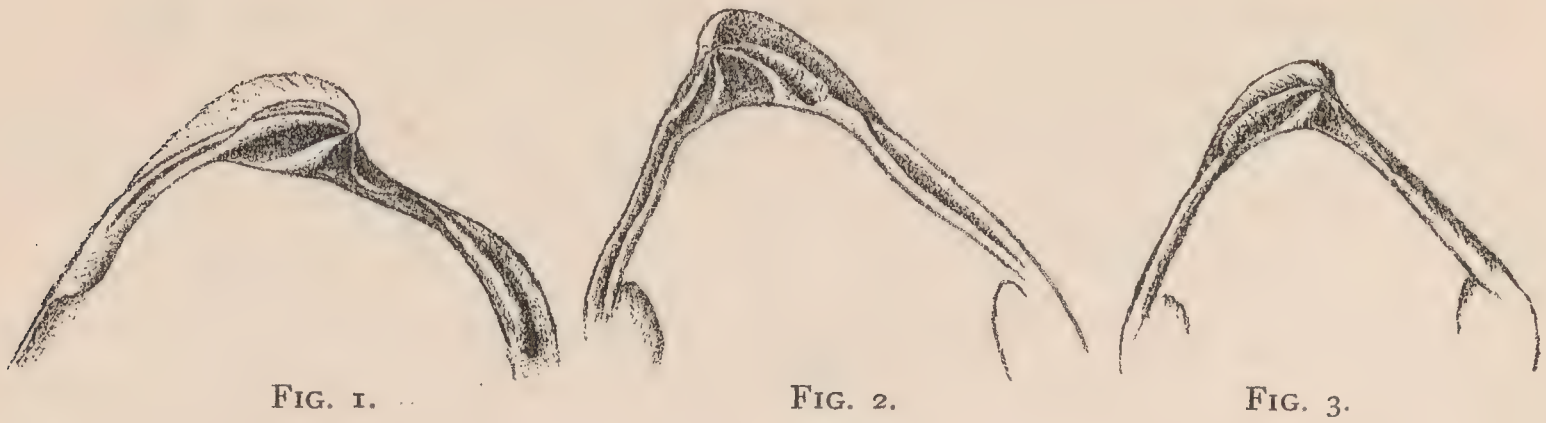


FIG. 1. FIG. 2. FIG. 3.

DESCRIPTION OF FIGURES.—Fig. 1, hinge, enlarged, of the left valve of *P. undata*=*Opis undata*, Conrad. Figs. 2 and 3, hinge, enlarged, of *P. obruta* =*Opis obruta*, Conrad.

## PLATOPIS, new genus.

πλατυς flat, and *Opis* a genus of shells.

Small shells of triangular form, with an abruptly truncate or flattened posterior slope, and moderately incurved beaks. Hinge with diverging cardinal teeth, two in the right and one strong central tooth and two deep sockets with high bordering ridges in the left valve; right valve with lateral sockets, into which the edges of the left fit as teeth. Ligament slight, external; adductor muscular scars small; pallial line simple; margin not crenulate.

Types *P. undata* and *P. obrutus*, Conrad's sp.=*Opis undulata* and *O. obrutus*, Conrad, Off. Rept. Dead Sea, p. 222, Pl. 17, fig. 87, and p. 231, Pl. 2 App., fig. 9.

### **Platopis plicata**, n. sp.

PLATE 5, FIGS. 13–15.

Shell below a medium size, transversely triangular in outline, somewhat cuneiform in a cardinal profile, very ventricose anteriorly and sharp behind; anterior end vertically truncate, the rather small sharply enrolled beaks even with the longest part of the shell below; basal line broadly curved, with a scarcely perceptible sulcation just in front of the postero-basal angle; cardinal line gradually and constantly declining from the beaks to the posterior angle; umbonal ridge angular, almost carinate, the cardinal slope between the ridges of the two valves being depressed, but appearing twisted by the curvature of the shell;

disc of the valves very gently depressed between the umbonal angulation and the anterior ventricosity. Surface of the shell marked by fine concentric lines of growth only; sometimes, however, gathered into faint ridges. Interior of right valve with the posterior cardinal tooth very much elongated posteriorly, while the anterior one is correspondingly small, and in the only example observed is only partially separated from the inner ridge of the anterior lateral groove; both anterior and posterior lateral grooves rather long.

This species differs from all the others described in the apparent twisting of the valves, in its cuneate form, as seen in a cardinal profile, with vertical anterior end and extremely ventricose rounded anterior part of the shell, and in being longer than high. From *O. obrutus*, Conrad sp., it differs in wanting the high and sharp beak, and from *O. acqualis* of the same author, both associated with it, in the short anterior end.

*Locality.*—In the Abeih sandstone at Ducûn, near Abeih, Syria.

### **Platopis? triangularis,** n. sp.

PLATE 5, FIGS. 16 AND 17.

Shell rather small, almost equilaterally triangular in outline, the greatest antero-posterior length very little greater than the height; beaks central, slightly incurved and pointing anteriorly, not enrolled; postero-cardinal slope vertical, or very slightly depressed between the very angular posterior umbonal ridges; anterior end a little more rounded than the posterior, and the basal margin very regularly curved; disc of the valves very gently convex, and the surface marked by fine, rather even growth lines. Ligament quite small.

The equilaterally triangular form of this shell will readily distinguish it from any of those associated in this region, except *Mactra? olivensis* herein described, from which it may be distinguished by the less ventricosity, by the curving of the beaks, and by the angularity of the posterior-umbonal ridge. By this latter feature it may also be distinguished from *Astarte subcordata*, Conrad.

*Locality.*—In the brown clays and sandstones, at the Olive locality, near Abeih, Syria.

## CRASSATILLIDÆ.

### Genus SCAMBULA, *Conrad.*

### **Scambula secunda,** n. sp.

PLATE 6, FIG. 1.

Shell small, irregularly trapezoidal in outline and very compressed, almost flat; beaks small, pointed, closely appressed, situated a little nearer the anterior than to the posterior end of the shell; anterior end rounded, gradually passing into the basal border, which is broadly and nearly regularly curved; posterior end truncate, very slightly emarginate near the middle; postero-cardinal margin concave or excavated between the beaks and the posterior end, the cardinal face, or escutcheon concave. Disc of the valves marked by a distinct umbonal ridge, and the postero-cardinal slope concave. Surface of the shell marked by concentric undulations, very much coarser on the posterior portions than on the anterior portions of the shell, strongly bent on the umbonal angle and retrally undulated as they cross the postero-cardinal slope. Besides the undulations, fine concentric striæ can be observed under a glass, which are independent of the undulations and cross them, showing that the undulations are not quite parallel to the margin of the shell. Interior unknown.

This species differs from *Scambula perplana*, Conrad, Pal. New Jersey, Vol. 1, Pl. 18, figs. 8-10, in being less prolonged and acuminate posteriorly, and in having much finer undulations. It is very interesting to find a second species of this genus of shells, although it differs so much specifically from the one found at the base of the New Jersey Cretaceous of this country, it is nevertheless very readily recognized externally as generically identical. There may be some slight doubt as to the true family relations of these shells, the specimens being small and so few in number, as well as a little obscure in their muscular markings, make it difficult to satisfactorily determine what their affinities are. The general form is so nearly like that of *Telledora*, *Pandora* and *Myodora*, that one naturally expects to see them classified near them. But they appear to be equivalve, and the American species, of which good interiors exist, show the crenulated border and other features, which would seem to ally them to the

*Astarte* and *Crassatella*, as well as do the features of the dentition.

*Locality.*—In the clayey seams of the Abeih sandstone, near Abeih, Syria. Somewhat rare.

GOULDIA, *C. B. Adams.* ERIPHYLA, *Gabb.*

**Eriphyla cranulicosta,** n. sp.

PLATE 6, FIGS. 2–5.

Shell small, greatest diameter scarcely exceeding 6 or 7 mm., triangularly elliptical in outline, with depressed convex valves, which are strongly marked externally by prominently elevated concentric ribs, and by finer radiating lines which can readily be seen by the unaided eye. The concentric undulations are abruptly bent near the posterior cardinal border, and thickened between that point and the margin, exactly imitating some of the West India species of *Chione* (*Omphaloclathrum*). Lunule large and deep, and the entire cardinal area deeply excavated. In the interior the ligamental pit beneath the beak is large and deep, the anterior margin of the hinge plate grooved in the right valve, and the posterior one on the left valve for the interlocking of the valves.

The shells of this species are so very like the group of *Chione* referred to above externally that if the interior had not been seen I should certainly have referred them to that group.

*Locality.*—In the clayey layers at Bewerty, about three miles west of Abeih, Syria, above the Abeih sandstone.

## LUCINIDÆ.

Genus LUCINA, *Bruguiere.*

**Lucina percancellata,** n. sp.

PLATE 6, FIG. 6.

Shell quite small, scarcely exceeding 5 or 6 mm. in height, and but little longer than high; being nearly circular in outline and a little lower behind than in front of the beaks; beaks small nearest to the anterior end, surface of the valves depressed convex, marked by proportionally strong, radiating and concentric elevated striæ and ridges, the radiating lines more numerous

than the concentric ones, but of about equal strength, forming by their combination a very deeply cancellated surface structure, which extends over the entire shell.

The peculiar markings of the surface, together with the circular form, small size, erect and nearly central beaks, form the distinguishing features of the species.

*Locality.*—In the coarser part of the Abeih sandstone, at the Olive locality, near Abeih, Syria.

## CARDIIDÆ.

### Genus CARDIUM, *Linn.*

**Cardium bellum,** *Conrad*, Off. Rept. Lynch's Expl. Dead Sea, p. 225, App., Pl. 1, fig. 3.

*Cardium Hillanum*, var. *Moabitica*, Lartet, Geol. Palestine, Ann. des Sci. Geol. France, 1872, p. 53, Pl. 12, fig. 9.

*Protocardium Moabitia*, Noet., Zeitsch., 1886, p. 867, Pl. 27, fig. 3; Blanck., Biet. zur Geol. Syriens, 1890, p. 90.

There can be no question, I think, as to the identity of the specimens considered under the above citations of authors, and I can see no valid reason why Mr. Conrad's name, which was the first given, should not be accepted as that of the species. This same observation would as well apply to several other species as to the above, such as *Panoped orientalis*, and several others.

### **Cardium (Serripes?) Bewertense,** n. sp.

PLATE 6, FIGS. 11–14.

Shell attaining a diameter of 5 cm. or over; subquadrangular in general outline, with moderately large, slightly incurved beaks, situated a little anterior to the middle of the shell; valves only moderately ventricose, the casts being depressed convex only; umbonal ridge subangular, with a flattened cardinal slope and almost squarely truncated posterior end. Surface of the shell marked only by fine concentric lines of growth. In the interior the hinge plate is rather narrow posteriorly, anteriorly it is very well developed, with a proportionally large antero-lateral tooth, the postero-lateral being distinct but not large. Cardinal teeth well developed. Muscular scars, as shown on internal casts of large size, but of moderate depth.

This shell resembles *Hemicardium Hillanum*, Sow., in its quadrate and nearly equilateral outline, but differs materially in being less ventricose, and entirely so in wanting the surface markings, there being only the fine concentric lines of growth.

*Localities.*—In the clayey limestone of the Bewerty beds, at Bewerty, preserving the shell in good condition; and as casts only at Naaman, about 5½ miles east of Aithath, Beyrut district, Syria. A single valve of smaller size, but having characters too similar to be separated from it, has been obtained from the Abeih sandstone at Duccûn, near Abeih.

### **Cardium (Protocardium?) Birdanum**, n. sp.

PLATE 6, FIGS. 7–10.

Shell below a medum size, the largest one observed having a length of 27 mm. and of equal height, including the beaks, or 24 mm. from the base of the shell to the top of the hinge line; valves very ventricose, with large, prominent subcentral beaks which are strongly enrolled. Anterior end narrower than the opposite, rounding into the basal line; posterior end obliquely truncate, squarish on the postero-cardinal angle, the posterior slope slightly concave. Surface marked by very fine radiating lines, and on the posterior end and slope by somewhat coarser radii, which are more deeply marked; those on the anterior end and disc being scarcely impressed. Very fine microscopic transverse lines of growth cancellate the radii. Shell margin finely crenulated. The callosity in front of the beaks is proportionally quite large, very much elevated, and when the valves are united presents a nearly circular outline.

This shell resembles *C. subhillanum*, Leym., as figured by d'Orb., Terr. Cret., Pl. 239, figs. 7 and 8, except in the angularity and truncation of the posterior end; the French shell being rounded or subcircular. Leymerie, in the original description and figure (Mem. de la Soc. Geol. France, Vol. 5, p. 5, Pl. 7, fig. 2), gives nothing of the truncation of the anal end, or of the stronger striæ on this part of his shell. Consequently I can only conclude this to be a very distinct species.

*Locality.*—Common in the Abeih sandstone at Duccûn, near Abeih, Syria.

## ISOCARDIIDÆ.

### Genus TRAPEZIUM, *Humph.*

= *Trapezium*, Mulhf. not Blainvl. *Cypricardia*, Lamk.

### **Trapezium Naamanense,** n. sp.

PLATE 6, FIGS. 15 AND 16.

Shell small, none of those observed reaching more than 12 mm. in length, elongate trapezoidal in outline, with proportionally large enrolled beaks, situated at about the anterior third of the length; cardinal and basal angles parallel, the body of the valves appearing almost cylindrical in front of the very sharp, carinate umbonal angle, or in some cases showing a slight sulcus between the ridge and the anterior end; anterior end sharply rounded, and the posterior end obliquely rounded; posterior cardinal slope abrupt and the surface concave. Surface of the casts, the condition in which they occur, showing indications of radiating striæ, sometimes quite strong.

A small, but very neat and distinct species, found also in large numbers, the cylindrico-trapezoidal form with the small size will readily distinguish the species from any of those with which it is associated. It is as nearly like *Arca fabiformis*, Con., Lynch's Dead Sea, Pl. 17, fig. 97, as any one of the series, but is far more cylindrical, and longer anteriorly, and not so high proportionally.

*Locality.*—As casts, retaining the external form and surface markings, quite frequently in the light ash-colored calcareous clays at Naaman, 5 to 6 miles east of Aithath, in beds resting above the brown gasteropod clays, Beyrût district, Syria.

## ? CYPRINIDÆ.

### Genus VELEDA, *Conrad.*

### **Veleda elliptica,** n. sp.

PLATE 7, FIGS. 1 AND 2.

Shell small, 20 to 25 mm. in length, transversely subelliptical in outline, the beaks breaking the elliptical outline on the cardinal border by projecting a little beyond the regular line. Valves very depressed convex on the disc, and strongly incurved

at the postero-cardinal margins; beaks small, slightly pointed, situated a little in advance of the centre and directed anteriorly; anterior end scarcely narrower than the posterior; lunular area very slightly impressed on the larger specimens, while the posterior cardinal border are strongly inflected; ligament short, situated close to the beaks. Surface marked by proportionally strong concentric lines of growth, strongest on the posterior end of the valves.

These shells are small, and like the American types of the genus, rather obscure, although very *Tellina*-like in their general features; they are, however, equivalve, want the twist of the valves of *Tellina* and the posterior sulcation common in that genus.

*Locality.*—In the Abeih sandstone, at the olive locality, just below Abeih, Syria.

### **Corbicula (Batissa?) Hamlini,** n. sp.

PLATE 6, FIGS. 17–22.

Shell transversely subelliptical, oval or subquadrate in outline, the latter form being the most common. In size varying from 25 to 30 mm. long, and moderately ventricose, with rather strong but not prominent beaks, directed anteriorly and generally situated at about the anterior third of the length, but often nearer the anterior end; sometimes the posterior end is subtruncate and the umbonal ridge perceptible. No lunule visible, and the ligamental depression is narrow and frequently indistinct. Surface of the shell marked by strong concentric lines of growth only.

In the interior the hinge is corbiculoid, the right valve has two subequal cardinal teeth only, near each other, and directly beneath the beak; a long lateral groove occurs on each side; left valve with two cardinal teeth, the anterior very thin, the posterior thickened; antero-lateral long and slender, postero-lateral apparently formed by the margin of the valve only; muscular scars large, submarginal and remote; pallial line not observed. This species differs from *Gonodon? hebes*, Hamlin, Mem. Mus. Comp. Zoöl., Vol. 10, p. 52, Pl. 4, figs. 1*a* to *c*., which it most nearly resembles of any in this district, in being a smaller

shell, much less ventricose, with very much smaller and less central beaks, and entirely so in the hinge structure. It somewhat resembles *Astarte arctata*, Conrad, Off. Rept. Dead Sea, p. 215, Pl. 20, fig. 119, in general outline, but has the beaks directed more anteriorly, and the profile given by that author is altogether different from what this shell would give. Cardium? sp., also of that author, loc. cite., p. 217, Pl. 15, fig. 76, somewhat resembles it, but is more equilateral.

The shell is doubtless a *Corbiculoid*, and near *Batissa*, Gray, but differs in having only two instead of three cardinal teeth in each valve, otherwise it agrees very well. It also comes near the genus *Isodoma*, Desh., a Tertiary shell, but the cardinal teeth are not bifid and are less divergent, so I have chosen to place it provisionally under *Batissa*.

*Locality.*—The shell appears to be abundant at Duccûn, near Abeih, Syria, in the coarser layers of the Abeih sandstone, the grains of sand have entirely obliterated the pallial line, so it is not observable. There is also a single internal cast, apparently of the same shell, from Marahh, Syria, in the yellowish-brown clays of the Bewerty beds.

## CYRENIDÆ.

### CORBICULOPSIS, new genus.

*Corbicula, a genus of shells, and ὄψις appearance.*

Shell transversely quadrate, with appressed beaks anteriorly placed, valves with angular umbonal ridge, and concentrically marked. Hinge but slightly arcuate, three small cardinal teeth in each valve, the posterior one largest; antero-lateral tooth short, large, transverse, placed near the cardinals; posterior-lateral distant, elongate, leaving a flattened space in front. Ligament external, slight. Muscular imprints and pallial line yet unknown.

The shells for which the above name is proposed are transversely elongated and concentrically striated, having an angular umbonal ridge, and presenting much the appearance of shells like *Tapes* (*Parembola*) *litterata*, Linn., but somewhat more angular on the umbonal ridge. The hinge, however, which forms nearly a straight line, has the elements of that of *Corbicula*

somewhat subdued. Among the genera of fossil forms perhaps *Leptesthes*, Meek, proposed for a group of Laramie shells, is the nearest, but externally are quite unlike, while the hinge teeth are far more *Corbicula*-like in size and arrangement than are those of the Syrian forms; so much unlike that it is difficult to consider them as generically similar.

### **Corbiculopsis Birdi**, n. sp.

PLATE 7, FIGS. 3–7.

Shell attaining a length of from 5 to 6 cm., with a height of rather more than 3 cm., cardinal and basal borders subparallel, widening somewhat posteriorly; anterior end less than one-third of the entire length, rounded; posterior end obliquely truncate, slightly rounded on the margin; the basal line is slightly rounded in shells of young or medium growth, but in the older specimens becomes very slightly emarginate just anterior to the middle of the shell's length; beaks small, appressed; umbonal ridge subangular, and the posterior slope sometimes very slightly concave. Surface of the shell marked by moderately strong concentric lines of growth only.

This shell presents exactly the form and proportions of *Unio complanatus* of the eastern American rivers, or very nearly that of *Tapes litterata*, Linn., among the marine forms, and is peculiar among Cretaceous bivalve shells in this character. It is possibly the form identified by Dr. Frass as *Venus Royana*, d'Orb., from which it differs generically.

*Locality.*—This species is common in the coarser layers of the Abeih sandstones at Duccûn, near Abeih, Syria.

## VENERIDÆ.

### Genus ARCOPAGIA, *Leach.*

### **Arcopagia planissima**, n. sp.

PLATE 7, FIGS. 8 AND 9.

Shell rather large, transversely broad-oval, very compressed inequivalved and slightly twisted or bent, the right valve the most convex; beaks a little anterior to the middle, and judging from

the internal casts alone they appear to have been quite compressed and inconspicuous; the groove left by the hinge plate between the two valves, on the casts, is quite marked, and the pit between the beaks from the thickening of the hinge-plate below the cardinal teeth quite distinct. Muscular scars distinct and of moderate size; pallial line not discernable.

This species differs from *A. depressa*, Coq. ("Pal. Constantine," Pl. 6, figs. 8 and 9), in being much more circular in outline. In this respect it closely resembles the form described by Conrad, from the New Jersey Cretaceous Marls, as *Cyprimeria depressa* (see Pal. N. J., Vol. 1, Pl. 22, figs. 11-13), but the posterior slope has been much narrower.

*Locality.*—In the brown clays above the Abeih sandstone, at Shimlan, Syria.

## Genus CARYATES, *Roemer.*

### **Caryates globulus,** n. sp.

PLATE 7, FIGS. 10 AND 11.

Shell below a medium size, globular in form when not distorted; the rather strong beaks being subcentral and directed anteriorly, but not remarkably so. Ligament small, but distinct. Surface marked only by concentric lines of growth, but these are rather strong, very distinctly marked and often gathered into indistinct groups.

The distinctly globular form of this shell, together with the moderately strong subcentral beaks, will serve to distinguish it from any of the associated species. I have not seen the interior of the hinge, but there can be but little doubt of its generic relations. Shells of this group have often been referred to the genus *Thetis*, Sow., by many authors, but if the small triangular shells, like those usually referred to *Gouldia*, C. B. Adams, are to be considered as characteristic of that genus, as is done by many good authorities, these certainly cannot be arranged with them.

*Locality.*—Not uncommon in the Abeih sandstone at Duccûn and the Olive locality near Abeih, Syria.

### Genus CALLISTA, *Poli.*

### **Callista Syriaca,** n. sp.

PLATE 7, FIGS. 14 AND 15.

Shell of medium size, the largest example of an internal cast measuring 4½ cm. in length by a height of nearly 3 cm. at the beaks, the thickness being about 12 mm. General outline elliptical, with small beaks directed anteriorly, and situated at about two-thirds of the length from the anterior end. Anterior end with the cardinal border rather deeply excavated in front of the beaks, and the extremity sharply rounded; basal line regularly curved; posterior end less sharply curved than the anterior; posterior cardinal margin gently arcuate from the beaks to the posterior end. Muscular imprints on the casts rather indistinct; pallial sinus sharp and pointed toward the beaks. In a cardinal profile view the form of the cast is narrowly elliptical with approximate appressed beaks.

These casts somewhat resemble that of *Venus Reynesi*, H. Coquand, Pal. Constantine, Pl. 7, figs. 11 and 12, but is more elongate with much less elevated beaks and a less thickness through the valves.

*Locality.*—In the light ash-colored clays at Naaman, Syria. Not uncommon.

## TELLINIDÆ.

### Genus DONAX, *Linn.*

### **Donax minutissimus,** n. sp.

PLATE 7, FIGS. 12 AND 13.

Shell almost minute, cuneiform, thick at the anterior end and narrowing posteriorly both in height and thickness; nearly two-thirds as high at the beaks as the entire length. Anterior end very short and gently curved, the anterior slope rather abrupt and the basal line very gently arcuate; posterior end narrowly rounded; beaks small and closely incurved, close to the anterior end. Surface apparently finely striated. Length about one-fourth of an inch.

Apparently a true *Donax*, and remarkable only for its small size.

*Locality.*—In the Abeih sandstone at the Olive locality near Abeih, Syria.

## MACTRIDÆ.

### Genus MACTRA, *Linn.*

### **Mactra? Olivensis,** n. sp.

PLATE 7, FIGS. 16 AND 17.

Shell small, triangular; height and length about equal; very ventricose with small, subcentral approximate beaks, scarcely curved anteriorly; anterior end of the shell a trifle the longest, and the posterior very slightly truncated vertically; basal line regularly curved. Surface of the shell under a magnifier sometimes showing faint radiating lines, which seem almost as if due partly to a form of exfoliation, as it does not appear on all examples.

I am not certain that this shell ought to be placed under *Mactra*, although there is but the one external feature that does not agree well with the characters of that genus, viz., the apparent striated surface. I have not seen the interior, consequently cannot feel sure.

*Locality.*—In the clayey layers of the Abeih sandstone at Olive, near Abeih, Syria.

## ANA INIDÆ.

### Genus ANATINA, *Lamarck.*

### **Anatina? orientalis,** n. sp.

PLATE 7, FIG. 18.

Shell of medium size, transversely ovate, with nearly central, somewhat prominent, erect beaks, situated nearest to the anterior end. Valves broadest anterior to the beaks and narrowed posteriorly; wide end almost vertically truncate, longest above the middle; narrow end more sharply rounded. Substance of the shell very thin and fragile, and the surface beautifully and evenly marked with fine concentric lines, scarcely visible except by the aid of a lens.

I am by no means certain that this is a true *Anatina*, as I have not seen anything of the hinge, but the form of the valves and

general character of the shell lead me to believe it most nearly related to this group. A smaller individual than that figured would indicate that the shell in its younger stages was more distinctly rounded at each extremity than when more fully grown.

*Locality.*—At Shweifat, in the Beyrût district, Syria, in rocks which are equivalent to the chalks of Andrifil, which are about the highest of the Cretaceous rocks of the Beyrût district.

## CORBULIDÆ.

### Genus CORBULA, *Burguiere.*

### **Corbula olivæ,** n. sp.

PLATE 7, FIGS. 19–21.

Shell of medium size, one fragment of a right valve giving positive evidence of a length of 12 mm.; a smaller but perfect shell, exceeds one centimetre very slightly, with a height of right valve of 8 mm., and a thickness of the two valves, in place, of 6 mm. Right valve very ventricose, subtrapezoidal; beak large and enrolled, overhanging the hinge line, terminal anteriorly; posterior end caudate on the line of the hinge, which is straight; anterior end truncate, abrupt, impressed below the beaks; disc of the valve with strong, rounded, concentric undulations, extending anteriorly and posteriorly. Right valve small, convex, destitute of concentric furrows, but with several obscure radii on an otherwise smooth surface; anterior umbonal ridge strongly marked.

The peculiar trapezoidal form of the right valve, coupled with its strong, rounded, concentric undulations and the faint raised radiating lines of the smaller valve will distinguish this species. The right valve is heavy and dense, and the hinge is marked by a strong tooth and a very deep pit, which extends beneath the large enrolled beak. The left valve has not been obtained separated.

*Locality.*—In the Abeih sandstone at the Olive locality, near Abeih, Syria.

# GASTEROPODA.

## TURBINELLIDÆ.

### Genus CARICELLA, *Conrad.*

### **Caricella planilirata,** n. sp.

PLATE 8, FIGS. 1 AND 2.

Shell rather above the medium size, the type used being about 7½ cm. in length ; obovate in general outline, the upper portion of the body whorl being somewhat inflated ventricose. Volutions, five or more, angularly rounded on the upper face, the exposed part of each, above the body whorl, forming nearly or quite a quarter section of a circle, as seen in profile. Body whorl proportionally large, forming on the apertural face, about four-fifths of the entire length, while the aperture, which is elongate semilunar in outline, forms a little more than three-fourths of the entire length. Surface of the shell, as shown on the cast, marked by broad, low convex, spiral bands, and on the shoulder of the last volution, a little below the suture, by a depressed concave groove. Substance of the shell apparently thin. Columella somewhat curved, and so far as can be ascertained from the type specimens, shows no evidence of folds.

The shell may possibly not be a true *Caricella*, owing to the apparent absence of folds on the columella, still they may have existed, as the specimen is in a hard compact limestone which does not readily separate, and I have but the one very imperfect specimen. If it should not possess the folds it would then naturally fall under the genus *Ficus*, Ross, but the surface has not been cancellated, and the general resemblance is like *Caricella.*

*Locality.*—In limestone between Shimlan and Aitath, north of Abeih, Syria, above the Bewerty clays.

## VOLUTIDÆ.

### Genus VOLUTOMORPHA, *Gabb.*

### **Volutomorpha? orientalis,** n. sp.

PLATE 8, FIGS. 3 AND 4.

Shell rather small, the largest individual being only two and a half centimeters long, with the three upper volutions absent.

Spire very much elevated, the volutions being rather high between sutures, and more than moderately convex; the last one when measured on the back forming nearly one-half of the entire length of the shell, making the aperture correspondingly long. Surface smooth or marked only by fine lines of growth.

This species is much like *V. bella*, Gabb, from the Cretaceous marls of New Jersey, U. S., but has different proportions from any of those recognized, and does not show any vertical folds or other sculpturing, and I have no positive evidence of any fold on the columella, so it is possible it may not belong to this group.

*Locality.*—In the Abeih sandstone at Duccûn, Syria.

## PLEUROTOMIDÆ.

### Genus MANGELIA, *Leach.*

### **Mangelia? solitaria,** n. sp.

PLATE 8, FIGS. 5 AND 6.

Shell small, measuring only 12 to 15 mm. in length, with a very slender, elevated and turriculated spire, composed of eight or more volutions, which are slightly shouldered or chamfered at the upper margin, the general form of the volutions being slightly convex between sutures. The last volution, as measured on the front side equals one-half of the entire length of the shell, the aperture alone being rather more than one-third. Aperture narrowly oblique, prolonged slightly to form the short, narrow, twisted canal, and the outer lip distinctly notched close to the suture. Inner lip not callus or coated. Surface of the shell marked by a few raised, spiral lines most conspicuous on the base of the volution.

The absence of a callus on the inner lip on this shell renders its correct reference to *Mangelia* somewhat doubtful, but its other features make it fully as difficult to place in any other division of the *Pleurotomidæ*, while the very decided slit in the aperture shows it to belong unquestionably in this group.

The figure given on block fig. 1, letter *a*, at the base of figure in centre of Pl. 6, Blanckenhorn, Betrag. zur Geol. Syriens, referred to *Nerinea minima*, is very similar to specimens of this shell, but these are certainly not *Nerinea*.

*Locality.*—In the brown clays near the top of Gazelle Mt., near Abeih, Syria.

## STROMBIDÆ.

### Genus STROMBUS, *Linn.*

### **Strombus? crassaliratus,** n. sp.

PLATE 8, FIG. 7.

Shell large, the internal cast being about 11 cm. in length, and represent only the parts within the expansion of the outer lip, indicating a large and somewhat ponderous shell, having a narrow conical form, with a very short convex spire, the inner whorls of which are more slender and are more elevated than the outer ones, which are rounded between the sutures. Surface of the cast marked by very coarse spiral ribs or ridges, which on the back of the cast are more than one-fourth of an inch in width, and number about ten or eleven on the shell below the angle of the volution.

This cast is so distinct and remarkable that, although showing but few of the specific features, I have thought it desirable to present it as a member of the Syrian Cretaceous fauna. The strong lirations will readily distinguish it when coupled with its cone-like outline. The specimens referred to *S. Mermeti*, Coq., Geol. et Palæont. de la Constantine, Pl. 5, fig. 2, is so much shorter and less conical, that it will not be easily confounded with this.

*Locality.*—Between Shimlan and Aitath, north of Abeih, Syria, in brown clay-limestones above the Bewerty clays.

**Aporrhais pleurotomoides,** *Blanck.*, Betrag. zur Geol. Syriens, p. 115, Pl. 9, figs. 8–10.

From a number of specimens of this species it is shown to belong to the *Pleurotomidæ*, and probably to the section *Drillia*. The shell possesses a peculiar feature in having a strong varix half a turn back of the true aperture, representing a previous lip margin at that point, in all of the adult specimens. This feature is partially shown on Dr. Blanckenhorn's fig. 9.

**Alaria monodactyla,** *Hamlin*, Mem. Mus. Comp. Zoöl. X, p. 28, Pl. 2, figs. 6, *a–c*.

Specimens representing this species from Bewerty show it to be entirely a distinct species, having no relations with *Turritella* (*Cerithium*) *magnicostata*, Conrad, as cited by Dr. Blanckenhorn, loc. cite., p. 111. The undetermined casts figured by Hamlin as fig. 9 *a*, *b*, are probably of this same species.

## NATICIDÆ.

**Natica (Gyrodes) orientalis,** *Conrad*, Off. Rept. Lynch, Expl. Dead Sea, p. 233, Pl. 5, app. fig. 41.

*Amauropsis abeihensis* (*Hamlin*), Blanckenhorn, Beit. zur. Geol. Syriens, p. 103.

A number of casts of this species shows it to have the top of the volutions flattened as is usual in the group referred to *Gyrodes*, and to be entirely distinct from *Amauropsis abeihensis*, Hamlin, as given by Blanckenhorn, p. 103 of his report. Conrad's specific name should therefore be retained under the genus *Gyrodes*.

### Genus AMPULLINA, *Lamarck*.

**Natica (Ampullina) fluctuoides,** n. sp.

PLATE 8, FIGS. 8–10, AND PLATE 9, FIGS. 1 AND 2, VARIETY.

Shell of only a medium size, the largest individual observed scarcely exceeding two centimeters in its greatest diameter, which is across the aperture nearly at right angles to the inner line of the columellar lip. The outline form, as viewed on the plane of the aperture, is a broad oval, the two diameters of which are as five to six; and the height of the back of the shell, when resting upon the aperture, is equal to two-thirds of the short diameter of the oval. Whorls three to four, the last one forming almost the entire bulk of the shell, the inner whorls being nearly concealed, and the suture lines very obscure. Columellar lip covered by a smooth callus, the lower part of the lip thickened, and the outer margin thin and sharp. The entire form of the shell is, in fact, almost a minature of *A. fluctuata*, Sowerby, the living type of *Ampullina*, but the spire is even less prominent, and the callus a

little more limited, not spreading so far down on the columella. Surface of the shell smooth, except very fine, even, transverse lines of growth, and on the greater number of the specimens there are fine dark brown or blackish color lines, parallel to the lines of growth, but often interrupted in irregular patches or blotches, and also appearing darker in patches, but always interrupted at the margin of the callus. These probably represent original color lines existing on the shell during life.

The shell is so exactly similar to *N.* (*Ampullina*) *fluctuata*, Sowerby, that there can be no question as to their generic relations, if it were only possible to tell which of the several names applied by different authors to that shell were the right one to use as a generic appellation ; but this seems to be a question not easily decided, therefore I have selected *Ampullina* as the one most commonly used.

*Locality.*—In the yellowish brown clays at Bewerty, near Abeih, Syria ; and a single specimen from a darker brown layer at the Olive locality, near the same place. There are also twenty-six specimens in the collection from this last locality, which present the same features specifically, but are all of smaller size, the largest being less than a centimeter in its greatest diameter. They have the appearance of mature shells, and I am inclined to consider them more as dwarfed specimens than as representatives of a distinct species.

**Ampullina fluctuoides,** var., **acuminate,** new var. Pl. 9, figs. 1 and 2.—A single specimen presenting many of the features of the above species comes from the chert beds of Gazelle Mt., near Abeih. It is smaller in size, but may not be mature, but the spire is quite pointed as compared with that of *fluctuoides*, and coming from a somewhat higher geological horizon I am inclined to think it may represent a distinct species. Having but a single individual, however, I have indicated it as a variety provisionally.

### **Natica (Ampullina) minima,** n. sp.

PLATE 9, FIGS. 5 AND 6.

Shell small, the largest of ten specimens measuring about eight mm. in its greatest diameter when resting on its aperture ; form

in outline, ovate, the apertural border widest; last volution forming almost the entire visible portion of the shell, the spire being nearly enveloped within it. Aperture proportionally large, semilunate in form, and the columellar lip coated by a thick heavy callus, which spreads down and upon the lower lip of the aperture as in *A. fluctuate*, Sowerby.

This species differs from *A. fluctuoides* herein described, in being smaller and less symmetrically oval in outline, but principally in its color markings, which consist of two narrow spiral bands of brown, one of which occupies the middle of the volution, and the other occurring midway between that and the base of the shell; these bands are made up of transverse colored lines parallel to the lines of growth; on the space above the upper band there are irregular zigzag lines, and between the two bands other narrow tortuous lines of the same color, the whole coloration very well representing that on a two-banded specimen of *Natica canrena* of the present seas.

*Locality.*—In the brown calcareous clays near the summit of Gazelle Mt., near Abeih, Syria. The horizon of this shell is much above that of *A. fluctuoides*.

### Genus NEVERITA, *Rissoa.*

### **Neverita patula,** n. sp.

PLATE 9, FIGS. 3 AND 4.

Shell small, the greatest diameter of the only two individuals examined, being twelve and thirteen mm. respectively, while the vertical height is about eight mm. Volutions between three and four, very rapidly increasing in size; spire low, or depressed convex, but with distinct sutures, the inner coils rising but little above the outer one. Aperture proportionally large and patulose, the upper margin of the lip very much in advance of the lower portion, the whole being thin and sharp except between the base and the umbilicus. Umbilicus entirely covered by a large, thick and heavy callus, the lower portion of which is slightly depressed below the level of the adjacent volution, and the columellar face marked by a deep, strongly marked transverse groove, which reaches more than half way across the callus. Surface of the

shell marked by distinct transverse growth lines parallel to the lip, and also by proportionally large lozenge-shaped light colored patches on a dark ground, which forms a distinct net work, the long axis of the lozenges are arranged transversely.

The depressed form, large aperture, heavy callus with its deep groove, are distinguishing features, while the color markings, which are evidently life features, are remarkable.

*Locality.*—In the Abeih sandstone at Duccûn, near Abeih, Syria.

### **Natica ? (Amauropsis) scalaris,** Conrad's sp.

*Natica scalaris*, Conrad, Off. Rept. Dead Sea, App. p. 234, Pl. 7, fig. 50.

? *Amauropsis subcanaliculata*, and *gradata* (Hamlin), Blanckenhorn, Betrag. zur Geol. Syriens, p. 102.

? *Chenopus induratus*, Con. Off. Rept. Dead Sea, p. 220, Pl. 11, fig. 69.

I am not at all sure that the two forms described by Hamlin under the names above cited are the same as the *Natica scalaris*, Conrad, as stated by Blanckenhorn. If they are, then Conrad's *Chenopus induratus* must certainly follow. The short spired form given by Hamlin as *A. gradata*, I think may well be included under Conrad's name, but why Conrad's specific name should be suppressed after removal to a genus under which there is no species *scalaris*, I don't quite understand. Conrad's shell is well figured, and retains the shell substance, and is fairly described as descriptions were given at the time, and I think should hold. We possess in our collection several specimens of various sizes of the form given by Conrad, two of them larger and more thickened even than Conrad's specimen. On them the shell substance is very thick, in parts six or seven mm. The constriction on the body whorl is sometimes very deep, and the surface of the shell gathered into vertical folds parallel to the margin, while the upper angle of the inner volutions is frequently strongly nodose. The columellar lip is much thickened and callus, but is never umbillicate. The internal casts of young specimens is shorter than the common form of *A. gradata*, Haml., and strongly umbillicated. I consider *Amauropsis sub-canalicutata*, Hamlin, as quite distinct from Conrad's species.

**Amauropsis abeihensis,** *Hamlin*, Mem. Mus. Comp. Zoöl. Vol. X, p. 17, Pl. 1, fig. 2.

I have what I suppose to be this species from the Abeih sandstone at Abeih, Olive, Klelay and Duccûn, about thirty-five specimens in all. I find that the spire is generally much more elevated than in the one figured by Mr. Hamlin, sometimes very much more, in which case the sutures are not so deep. The form is generally very erect, the columella being almost vertical, and the callus slight, while as a prevailing feature there is a slight umbilical perforation. The fissuring of the columellar lip mentioned by the author occurs in only three of the specimens, and is apparently an accidental feature caused by a duplication of the columella within the umbilicus, while it is continuous below, resembling a varix somewhat.

## SCALARIDÆ.

### Genus SCALARIA, *Lamarck.*

**Scalaria Bewertensis,** n. sp.

PLATE 9, FIGS. 8 AND 9.

Shell small, the longest individual recognized measuring 14 mm. has contained about twelve volutions, and presents an apical angle of fourteen or fifteen degrees. Another individual with a length of less than 13 mm. presents an apical angle of about twenty degrees. This last is marked by eight longitudinal varices, while the more slender one has fourteen. The volutions are short and moderately convex between sutures, and the terminal one has two spiral carina below the varices, the upper one of which interrupts them, the other being situated very close to it. Aperture nearly round ; the outer lip being imperfect in both examples figured fails to give the entire features of the mouth ; axis imperforate. The varices are sharply elevated, and are slightly bowed backward in the middle in crossing each volution, but are so aligned with those above and below as to present a continuous line with a spiral direction of about one-sixth of a turn in the length of the shell on the shorter of the specimens. The other is less regular.

It is possible these shells may be the representatives of two distinct species, but in the absence of other individuals I have considered them only as variations of a single one.

*Locality.*—Found in the yellow clays above the Abeih sandstone, at Bewerty, near Abeih, Syria.

### **Scalaria novemvaricosa,** n. sp.

PLATE 9, FIG. 7.

Shell of medium size, consisting of from eight to ten volutions, and having an apical angle of a little more than twenty degrees. Volutions very ventricose between the strongly-marked sutures, and crossed by nine strong, elevated, rounded, longitudinal varices, which form rigid vertical lines along the shell. Base of the last volution thickened; bordered at the lower sutural line by a thickened, elevated, spiral line, interrupting the longitudinal varices. Aperture ovate, longer than wide, slightly rimate below. Outer lip thickened by one of the varices. Surface of the entire shell marked by very fine spiral lines, which cross the varices and intermediate surfaces with equal strength, but of so fine a texture as to be invisible except by the aid of a lens; and when examined by a strong glass these are seen to be crossed by still finer vertical lines of growth, which give a crenulated feature to the spiral lines.

This shell differs from *S. Bewertensis*, herein described, in the strength and nature of the varices, and in the more convex volutions, the varices not being spirally arranged. From *Chemnitzia, Syriaca*, Frass, Aus dem Orient., Vol. 1, Pl. 1, fig. 4, which it somewhat resembles, it may be distinguished by the more ventricose volutions, smaller number of varices, and fine surface features.

*Locality.*—In the Abeih sandstone, at the Olive locality, near Abeih, Syria.

## TURRITELLIDÆ.

**Turritella peralveata,** *Conrad*, Off. Rept. Dead Sea, p. 221, Pl. 20, fig. 120.

*Eunema? bicarinata*, Hamlin, Mem. Mus. Comp. Zoöl. X, p. 24, Pl. 2, fig. 5.

*Glauconia Trechi*, Blanckenhorn, Beitrage zur Geol. Syriens, p. 101, Pl. 7, fig. 16 (10).

Comp. *Turitella Seetzeni*, Lartet., Geol. de la Palestine, p. 43, Pl. 9, fig. 9.

Comp. *T.*—(*Glauconia*) *geibeli* (Zek. sp.), Blancken., loc. cite., p. 100, Pl. 7, fig. 13.

This is one of the most variable species in the entire collection, varying from thirty to forty-three degrees in its apical angle in different individuals, and from those that are perfectly smooth to some much more deeply grooved, or strongly carinate than that figured by Mr. Hamlin as *Eunema ? bicarinata.* I have not found any, however, with more than two "*strong carinea*" on the exposed part of the whorls between sutures, though they often show one and sometimes two minor carina, one above and the other below the principal ones. It would be a very easy matter to make three distinct species if one had only the three extreme forms, but with a suit of forty to fifty specimens it is very easy to unite them into a single one. In the smoother forms the volutions are often strongly carinate just above the suture, usually on the upper three, and again on the last one, with the intermediate ones straight between sutures. The apertural half is again often contracted, giving a pupa-like form to the shell entirely unlike the normal form. This feature I have only seen on the smooth and on the semicarinate ones, while a few of the strongly carinate specimens have the last volution unusually enlarged. Dr. Blackenhorn seems to accept Hamlin's *Eunema bicarinata*, but cites Conrad's *T. peralveata* as a synonym of *T. ventricosa*, Forbes, with two question marks, which I think are more than fully required when one examines the original figures. He also recognizes *Turritella Seetzeni* of Lartet, referring it to the genus *Glauconia*, and describes a new species *G. Frechi* from a specimen which is quite typical of *Eunema bicarinata*, Hamlin, and which is also a very good representative of Conrad's figures of *Turritella peralveata.* From the study of this large group of specimens from near and around Abeih, I should consider all the above mentioned forms as of one single species, *Turritella peralveata*, Conrad, which was the first of the names given, and I think must be retained. Among the specimens of this set in our col-

lection there are also individuals which I am forced to include under the same name, because all the connecting links are seen which also fully represent Dr. Blanckenhorn's figure 13, of Plate 7, which he identifies as *Glauconia geibeli*, Zek. sp., which is intermediate between the ordinary *T. peralveata* and the smooth species above mentioned.

### Genus MESALIA, *Gray.*

### **Mesalia gazellensis,** n. sp.

PLATE 9, FIG. 10.

Shell small, seldom exceeding 12 mm. in length, and composed of eight or more volutions. Apical angle about fifteen degrees, but varying in different specimens to above or below this angle. Volutions very ventricose, the tube being circular in section, and the shell of nearly equal thickness, giving the outside of the volution about all the roundness possible, with deeply marked sutures. Aperture round, except for the slight extension of the columella in front; axis imperforate; surface smooth, or with faint indications of spiral lines.

*Locality.*—In the brown clays near the summit of the Gazelle Mt., near Abeih, Syria.

### Genus TUBULOSTIUM, *Stoliczka.*

### **Tubulostium? rugosum,** n. sp.

PLATE 9, FIGS. 15 AND 16.

Shell discoid, consisting of three or more whorls, which are coiled nearly on the same plane, and the outer whorls slightly embracing the inner on their ventral edge. Tube quadrangular externally and laterally flattened, making the dorso-ventral diameter somewhat greater than the lateral diameter, while the dorsum may be convex, flattened or concave as seen in different individuals. The surface of the tube is marked with longitudinal raised lines and transverse undulations, the latter becoming strongly developed and rugose, or even subspinose on the dorsal parts of the outer volution.

This species closely resembles the type species of *Tabulostium*, *T. discoideum*, Stoliczka, Pal. Indica Vol. II, p. 240, Pl. 18, figs.

20–25, in its general appearance except for the rugose character of the surface markings. I have not seen the tubular aperture, however, nor the spiral nucleus, as none of the specimens are perfect enough to show these features if they ever existed, nor can I distinguish more than two layers of shell matter in a cross section, so that I am not positive of its generic relations, and it may prove to be an annelid resembling *Spirula*.

*Locality.*—In the yellowish brown clays at Bewerty, near Abeih, Syria.

## Family PYRAMIDELLIDÆ.

### ODOSTOMOPSIS, new genus.

From *Odostomia*, a genus of shells and ὄψις, appearance.

PLATE 9, FIGS. 13 AND 14.

Shell univalve, naticoid in form, axis perforate, peristome interrupted, columella with a single strong fold or plication at the upper end near the body whorl; surface smooth, substance thick. Type *Phasianella abeihensis*, Blanckenhorn.

The above name is proposed for the shell described by Dr. Blanckenhorn as *Phasianella abeihensis*, and figured on his Pl. 7, fig. 4. The general form would be that of *Phasianella* were it not that the columella is straightened; has a large, strong fold, and that the axis is perforate. Dr. Blanckenhorn has described a second specimen of the same species under the name *Pyramidella amœna* at page 105, Pl. 7, fig. 21. The general form when entire is very like *Amauropsis*, but the fold on the columella entirely removes it from that group, and will ally it with the *Pyramidellidæ*.

### **Obeliscus bilineatum,** Conrad's sp.

*Cerithium bilineatum*, Conrad. Off. Rept. Dead Sea, &c., p. 233, App. Pl. 5, fig. 39.

*Phasianella* sp. (Lartet), Blanckenhorn, Beit. zur Geol. Syriens, p. 97.

This species I think is unquestionably an *Obeliscus* or very closely allied to that genus. See notes on this species under *Cerithium bilineatum* on page 428.

## Genus NERINEA, *DeFrance.*

### **Nerinea** species.

There are several distinct species of this genus in the collections studied, and among them some that are very variable at different stages of growth, but still more diverse in character when seen in different conditions of preservation. Mr. Conrad described six species from Syria, which he referred to this genus, one of which, however, *N. abbreviata*, Off. Rept. App., Pl. 5, fig. 36, is an *Actaconoid* shell, *Triptycha abbreviata.* Another, *N. orientalis*, Pl. 5, fig. 32, App. Offic. Rept., is a *Cerithium*, so that but four species are left of the six, as follows :

*N. Syriaca*, Conrad, Pl. 12, fig. 72.—This figure is accepted by Dr. Blackenhorn as the true *N. Syriaca*, and there is no question whatever as to his *N. Berytensis* being a section of the shell of the species of which Conrad's figure represents the internal cast.

*N. Bhamdunensis*, Conrad, Pl. 22, fig. 128 (by error in some copies 132)=*N. minima*, Blanckenhorn, Pl. 6, figs. 1 *a* and 2 *f*.

*N. cochleæformis*, Con., Pl. 4, App., fig. 29.—This has been identified by Lartet, Frass and Blanckenhorn as *N. gimmifera*, Coquand, which is, however, quite a differently ornamented shell, lacking the two lines of nodes in the depressions between the ridges, in which Conrad's shell much more closely resembles *N. monilifera*, D'Orb. It was also redescribed by Hamlin as *N. pauxilla.* All these names are subsequent to Conrad's, and must be discarded.

*N. cretacea*, Conrad, Pl. 16, fig. 25.—This may possibly be the same as *N. Schicki*, Frass, as cited by Blanckenhorn, although I cannot well see the identity; still, as Conrad's name has priority by about fifteen years, and was much better figured, it must hold if identical.

Mr. Conrad grouped several forms under the name *N. Syriaca*, from these Dr. Blanckenhorn has eliminated all but the one represented by fig. 72 of Conrad's report, as above-stated. Of this form there are fragments in the collection at New Haven which are nearly, if not quite, four inches in diameter. Of the other forms I have identified the following :

*N. Fleuriausa* (D'Orb.), Frass.

*N. Mamillæ*, Frass.

*N. Nobilis* (Munst.), Goldfuss.—Of this species some have reached a diameter of fully two inches. I am inclined to think that *N. abundans*, Frass, as figured by Blanckenhorn, Pl. 8, fig. 13, belongs here.

*N. Schicki*, Frass.—This gives us eight species for the Cretaceous formations in these parts of Syria. Quite a sufficiency.

**Cryptoplocus Libanensis,** *Hamlin*, Mem. Mus. Comp. Zoöl., X, p. 26, Pl. 2, fig. 8 *a*, *b*.

Very good shells of this species show a size much above that given by Mr. Hamlin, with volutions sometimes much more rounded, especially below, and with an open umbilicus, which, in one specimen, is open two-thirds of the shell's length, being in fact a hollow columella or axis. None of the specimens show or reveal, on working, anything of the necessary ridge on the upper side of the aperture necessary to constitute the genus *Cryptolocus*, and I am at a loss to know to what genus to refer it. It appears to be simply a perforated *Turritella*.

## CERITHIDÆ.

### Genus CERITHIUM, *Brugiere*.

**Cerithium magnicostatum,** *Conrad* sp.=*Turritella magnicostatum*, Off. Rept., p. 221, Pl. 10, figs. 63 and 64.

Not *Alaria monodactyla* (Hamlin), Blanck., or *Cerithium magnicostatum*, Noetling, Zeitsch. der Deutsch. Geol. Gesell., Pl. 27, fig. 5, 5 *a*, *b*, 1886, and as cited by Blanckenhorn.

The *C. magnicostatum* of Conrad is a very strongly marked species, and attains a large size. It never presents anything like the appearance of *Alaria monodactyla*, Hamlin, which is from a higher bed, and is a true *Alaria*, while Conrad's species is a large shell attaining a length of between three and four inches, and has a much thickened *cerithium*-like lip. It differs also greatly from the form figured by Noetling under the same name, and which I have herein described under the name *Potamides distortus*.

*Cerithium libanoticum* (Frass), Blanck., as given on Pl. 6, fig. 10, "Aus dem Oriet," Part II, is from a specimen of Conrad's *Cerithium magnicostatum* as I have identified his figure. This name is also found, according to Blanckenhorn, attached, by Dr. Frass,

to the fossils in the collection at Stuttgart, represented by fig. 10, Pl. 8, [VI.] of Part II, "Aus dem Orient," which is a very characteristic example of *Cerithium magnicostatum*=*Turritella magnicostata*, Conrad, as seen when partly denuded of the shell.

*Cerithium bilineatum*, Conrad, Off. Rept. Appendix, Pl. 5, fig. 39, p. 233. The specimens which I have identified with this figure and description belong to the *Pyramidellidæ*, and are near *Obeliscus*. The columella is short and has only one obscure fold bordering the very narrow basal channel. It varies greatly in the degree of expansion in different individuals, the apical angle of some being twice that of the others. They are all, however, slightly shouldered or chamfered on the upper margin of the volutions, the feature which I suppose to be what Conrad refers to as "bilineated." The general habit of the shell strongly reminds one of those on which Morris and Lycette founded their genus *Ceritella*, though their shell does not appear to have had so long a columella, and moreover shows evidences of a plication or fold. It is not uncommon in the brown clays near the summit of the Gazelle Mt., near Abeih, Syria.

### **Cerithium Conradi,** n. sp.

PLATE 9, FIGS. 11 AND 12.

Shell small, the usual size being about three centimeters in length. Spire elevated, slender and turrited. Volutions, about twelve in number, vertical on the exposed surfaces between outlines, and somewhat step-like, or shouldered, on the upper edge, especially on the last volution and near the aperture; lower side of the last volution angular, squarish, presenting the appearance of that of a species of *Turritella* when the aperture is imperfect. Aperture small, scarcely expanded, the lower canal quite indistinct, but visible; posterior canal stronger, formed principally by a pinching together of the side of the volution; inner lip distinct. Surface marked by two spiral lines of nodes, the upper strongest and just below the suture; the lower line of smaller transverse nodes situated just above the suture. On the base of the last volution a sharp seminodose carina marks the lower lateral angle with two or more spiral lines between it and the beak.

Somewhat resembles *C. Gallicum*, D'Orb., Pal. Franc. Terr. Cret. Vol., Pl. 231, fig. 7, but differs entirely in the form of the aperture and canal.

*Locality.*—In the Abeih sandstone at Duccûn, near Abeih, Syria.

Genus VERTAGUS, *Klein.*

**Vertagus coloratus,** n. sp.

PLATE 9, FIGS. 17 AND 18

Shell of medium size, attaining a length of about 32 mm., and composed of ten to twelve volutions. Spire elevated, turreted, the volutions vertical on their outer face, and each one slightly shouldered at the top; giving a scalariform character to the whole spire. Aperture somewhat contracted on the back, the anterior canal twisted and reflected, and the posterior canal narrow and pinched as it were by the flattening of the aperture, giving an apertural axis very oblique to that of the shell. Surface of the shell marked by from twelve to eighteen vertical folds, fourteen or fifteen being the prevailing number, and also by alternating spiral thread-like lines, and on the base of the last volution by one strong spiral carina, more or less nodose, forming the angle of the volution; below which there are two or three other spiral lines, slightly nodose, with intermediate finer lines, like those on the body of the volution. Oblique columellar fold obscure or obsolete.

The stronger spiral lines on the volutions appear to be composed of a more dense substance than other portions of the shell, and are all of a deep brown color, appearing as color bands on the shell, sometimes very distinct and conspicuous.

*Locality.*—In the Abeih sandstone at Klelay, south of Abeih, Syria.

Genus POTAMIDES, *Brongniart.*

**Potamides? distortus,** n. sp.

PLATE 9, FIGS. 19 AND 21.

*Cerithium magnicostatum* (Conrad), Noetling, Zeitsch. d. Deutsch. Geol. Gesel., 1886, p. 872, Pl. 27, figs. 5 *a*, *b*.

Shell of about a medium size, the average length being about three and a half centimeters; spire elevated, turriculated, apical

angle about twenty-five to twenty-eight degrees; volutions ten to twelve, rounded between sutures and the latter distinct; last volution inflated and pouched in the outer half to form the somewhat expanded and eccentric aperture, frequently carinated on the back of the expanded portion; aperture large, transverse, the outer lip prolonged in the middle and the margin sinuous and thickened, canals indistinct; columella sinuous, flattened. Surface of the volutions marked by sixteen or seventeen vertical equidistant costæ, which are slightly bent backward in the middle, rounded on the crest and with concave interspaces; these become irregular, indistinct, or greatly exaggerated, and bent forward on the outer half of the last volution, but do not extend below the line of the periphery, but are there replaced by six or eight spiral lines, which become strong and deeply marked on the back of the mouth.

The earlier volutions of this species bears a very strong resemblance to the figures of *Scalaria Goryi*, Frass, from near the Dead Sea (Ann. des Sciences Geolog., Vol. 3, p. 44, Pl. 10, figs. 6 and 7,) and I had at first referred it to that species doubtfully; but, on critical study, I have concluded that it cannot be the same, as they never present the closely arranged vertical plicæ shown on his figures of natural size.

This shell has been referred to Conrad's *C. magnicostatum* by F. Noetling, as above-cited, but it bears not the slightest resemblance to that species, when compared with it. The shell does not conform strictly to the characters of the genus *Potomides*, or of any of the established groups of the *Cerithiidæ*. It seems to partake of those of that group and of *Tympanotus*, but not to be strictly referable to either of them. Neither the anterior or posterior canals are well developed, but both are indicated by broad sinuosities in the lip, while the outer border of the aperture is much thickened, flattened on the inside and its margin extended between the sinuosities. The general appearance of the shells might call to mind the genus *Arrhoges*, Gabb., and *Anchura* among the *Aporrhaidæ*, especially from the carination of the outer volution, but the form of the aperture at the junction of the columella entirely forbids this reference.

*Locality.*—In the Abeih sandstone at Duccûn, near Abeih, Syria. Rather abundant.

Genus CERITHIOPSIS, *Forbes and Hanley.*

**Cerithiopsis cretacea,** n. sp.

PLATE 9, FIG. 22.

Shell attaining a length of 12 or 14 mm.; very slender and turreted; composed of about ten volutions, which are closely and compactly coiled, with slightly marked sutures; the surface between the sutures being low convex; upper volutions increasing more rapidly than those below the middle of the length, where the shell becomes more nearly cylindrical. Aperture small, the inner lip reflected over the columellar side of the volution. Surface of the shell marked by five or six spiral ridges or lines of minute nodes or granules, with finer microscopic lines between; also by numerous irregular varices scattered throughout the length of the shell.

This species is almost a facsimile of living shells, known under the name *Cerithiopsis costatus*, DeCosta sp., from the European seas.

*Locality.*—In the Abeih sandstone, at the Olive locality, near Abeih, Syria.

## NERITIDÆ.

Genus NERITA, *Linn.*

**Nerita Abeihensis,** n. sp.

PLATE 10, FIGS. 1 AND 2.

Shell small, the largest diameter 8 mm. by a height somewhat less; form subglobose, slightly transverse; volutions about three in number, the inner ones exposed for about one-third of their diameter, and slightly elevated above the last one, although the latter forms nearly the entire bulk of the shell. Surface smooth, or marked only by transverse lines of growth; aperture semi-ovate, the opening narrow-crescentiform from the protrusion of the middle of the columellar lip, which is armed by a heavy projecting callus, divided in the middle so as to form two teeth, the division, however, being slight; outer lip thickened and sloping inward; columellar lip convex in the middle, and depressed at the lower part.

Differs from the two associated forms in its globose, naticoid form. Somewhat resembles *N. hemispherica*, Roemer, as figured by Morris and Lycett in their fossils of the Great Oolite, p. 58, Pl. 11, figs. 14 and 16, except in size and in the form of the callus of the columellar lip ; that one not being dentate.

*Locality.*—In the Abeih sandstone, at the Olive locality, near Abeih, Syria.

### **Nerita bidens,** n. sp.

PLATE 10, FIGS. 3–5.

Shell small, the largest of three individuals, all well preserved and well marked, measures just 9 mm., in its greatest diameter, by 5 mm. in height. Volutions in the larger one nearly or quite four, very rapidly expanding laterally, flattened on the top ; the inner ones sharply carinate on the margin, but the outer one rounded on the periphery. Aperture patulose, as wide as high on the margin, but contracted to vertically broad oval from the thickening of the outer lip and the concave margin of the columellar lip. Columella depressed, almost excavated, and marked by two proportionally large, distant teeth on the margin. Surface of the shell marked by transverse lines of growth. The older shell shows an inner light colored layer and an outer thicker layer of dark colored shell substance.

This species bears some slight resemblance to *Nerita pseudocostata* (D'Orb. sp.), Morris and Lycett, Pub. Palaeont. Soc., London, 1850, Mollusca Great Oolite, p. 114, Pl. 15, figs. 3 and 3 *a*, but is not so lofty, is more oblique, and is not so strongly plicated or costate.

*Locality.*—In the Abeih sandstone, at the Olive locality, near Abeih, Syria.

### **Nerita pagoda,** n. sp.

PLATE 10, FIGS. 6–8.

Shell small, the largest specimen observed measuring 7 mm. in its greatest diameter, which is obliquely across the aperture and body volution, while the vertical height is just about the same. Volutions about three or three and a half in the largest one. Spire elevated, having an apical angle of nearly or quite ninety degrees; periphery of the volution strongly carinate, and the

space above the carination concave. Aperture oblique, semilunate in form, the outer margin thickened and chamfered; columella somewhat depressed, its border marked with two strong teeth near the middle of its height. Surface of the shell smooth.

This species differs from the *N. bidens* in the elevated spire and carinated whorls with concave surface between sutures.

*Locality.*—In the Abeih sandstone at the Olive locality, near Abeih, Syria.

## TROCHIDÆ.

### Genus TROCHUS, *Linn.*

### **Trochus striatofundus,** n. sp.

PLATE 10, FIGS. 9–11.

Shell small, the largest individual obtained being only 8 mm. high by a transverse diameter at the base of nearly the same; spire only moderately high, having an apical angle of about forty-five degrees, and composed of about six volutions, which are flattened in the direction of the spire, with usually obscure suture lines; although several of the examples show the last volution, or one and a half volutions, so coiled as to contract the upper edge to considerable within that of the volution above it. Base convex; aperture oblique; margin continuous and thickened, giving the mouth a circular form within. Surface marked by three carinæ, one at the angle of the periphery, one at the upper or sutural margin, and one about midway between; between these there are one, two or three smaller spiral ridges. The base is also marked by numerous, rather fine, spiral striæ.

This species bears considerable resemblance to *T. spiratus*, D'Archiac, as figured by Morris and Lycette in the Vol. of the Palæont. Soc., London, publications for 1850, Mollusca from the Great Oolite, p. 106, Pl. 13, fig. 6, but differs in having a striated base. It is not a true *Trochus*, as the limits of that genus is now defined, nor does it appear to conform to any of the subdivisions of the family, but combines features of both *Trochus* and *Turbo*, so that it may ultimately be necessary to remove it to a division of its own.

*Locality.*—In the Abeih sandstone, at the Olive locality, near Abeih, Syria.

Genus MONODONTA, *Lamarch.*

**Monodonta antiqua,** n. sp.

PLATE 10, FIGS. 12 AND 13.

Shell small, the extreme height being between 9 and 10 mm., and the extreme diameter of the last volution, of the lagest specimen, about 1 mm. less. Volutions five to six, the last one suddenly deflected downward on the upper side just at the lip of the aperture, showing the adult age of the specimen; all the volutions are flattened between sutures in the direction of the spine; the last one rounded on the periphery and below; apical angle seventy to seventy-five degrees; aperture nearly round, much advanced on the upper side; lip thickened and bearing three teeth on the inner surface; columella somewhat flattened and bearing a strong tuberculiform tooth just at its base. Surface marked by about eleven spiral ridges, one on the periphery, four above it, and five below on the last whorl; also by transverse ridges of nearly equal strength and distance, cutting the upper surface into deep and strong reticulations; below the periphery the transverse ridges are finer and much subdued, only finely crenulating the spiral ridges.

Compares well with *Trochus monilitectus*, Philips, Morris and Lycett, Moll. Great Oolite, p. 116, Pl. 15, figs. 1 and 1*a*, but is broader and is lined below as well as above the periphery; but it differs materially also in the structure of the aperture. Dr. Max Blanckenhorn's *Delphinula Porteri* quite closely resembles this shell, but is more laterally spreading with more distinct sutures, besides it would appear to be umbilicated if referable to *Delphinula*, while this species is imperforate with the tooth of *Monodonta*. They are from the same horizon.

*Locality.*—In the cherts of Gazelle hollow, near Abeih, Syria.

## PHILINIDÆ.

Genus PHILINE, *Ascanias.*

**Philine (Megistostoma) patula,** n. sp.

PLATE 10, FIGS. 16 AND 17.

Shell rather large, having about the dimensions of *P. aperta*, Lam., or of *P. Schroeteri*, Phill., living species, or measuring

about 23 mm. in its greatest length ; broadly patulose in form, the coiled volution being small and much resembling that of the species above-mentioned. Coiled volution coated by the inner lip substance, so as to present a thickened margin or columellar edge, as in most forms of *Bulla*. Surface of the shell marked by distinct growth lines.

This species presents the features on the columellar lip of that described by W. M. Gabb in Vol. 1, Pal. California, p. 144, under the generic name *Megistostoma* (=*Megistoma*, Tryon, Struct. and Syst. Conch.), and if that genus should be adopted, would properly fall under it. Still the slight thickening of the inner whorl by a thin deposit on its surface is a rather poor generic distinction.

*Locality.*—Two specimens only have been received, and they are both from the coarse siliceous sandy parts of the Abeih sandstone, at Duccûn, Syria.

## TORNATELLIDÆ.

### Genus ACTÆONINA, *D'Orb.*

### **Actæonina Syriaca,** n. sp.

PLATE 11, FIGS. 10 AND 11.

Shell large, the largest individual in the collection having a transverse diameter of three centimeters, and must have been between seven and eight centimeters long. The perfect one has a diameter of about 23 mm. and a length of 6 centimeters. The general form is cylindrical, somewhat contracted below ; spire short, the apical angle varying in different specimens from seventy-five to ninety-eight degrees. Aperture narrow, very contracted above, wider below and narrowly rounded, from four-fifths to nearly nine-tenths of the length of the shell, in different specimens according to the height of the spine ; outer lip thin and sharp ; columellar lip thickened, reflected over the umbilical area below so as to present almost the appearance of an open umbilicus, but which is partially filled with a deposit. Surface of the shell only with irregular growth lines.

This shell looks like a cylindrical *Olive*, but differs entirely in the form of the aperture at the base. It is easily confounded

with *Actæonella Salomonis*, Frass, but on close examination is found not to have any plications on the very thick, strong columella; even when broken back to the extent of an entire volution, the columella is smooth.

This shell differs from *A. oviformis*, Blanck., Beitrag. zur Geol. Syriens, p. 117, Pl. 9, fig. 13, in the relative height of the spire and in its more cylindrical form. That one having a spire equal to or more than half the entire length, as shown by the figure, and the form is fusoid largest in the middle, while this one is cylindroid-oval, thus presenting an entirely different character.

*Locality.*—In the Abeih sandstone at Klelay, and a single individual, apparently the same, comes from the chert bed of Gazelle Mt., near Abeih, Syria.

### **Actæonina Marahhensis,** n. sp.

PLATE 10, FIGS. 18 AND 19.

Shell having a length of 15 mm. and a diameter of 7 mm.; form ovoid, spire moderately elevated, with six or seven volutions, not channelled, but slightly shouldered on the top, with distinct sutures; body volution moderately convex in the upper part, more rapidly rounded below to the base. Aperture two-thirds of the entire length, narrow above, and only moderately wider below; columella smooth, destitute of folds, curved at base and scarcely thickened. Surface with fine obscure spiral lines, closely arranged and alternating in size, at least near the base.

Differs from *A. vafra*, Hamlin, in its proportions, especially in the width of the aperture, and also in possessing the spiral lines, and from all and any of the other associated shells of this group, except *A. Syriaca*, Whitf., herein described, in wanting the columellar folds. From this latter it differs entirely in general form.

*Locality.*—As casts in yellowish clays at Marahh, near Abeih, Syria, in the Bewerty horizon.

**Actæonina vafra,** *Hamlin*, Mem. Mus. Comp. Zoöl., Vol. 10, p. 29, Pl. 3, fig. 1. This is a well-marked species, and is apparently quite abundant at Duccûn, near Abeih, in the sandstone. Dr. Blanckenhorn has cited this species as a synonym of *Natica olivæ*, Frass, Aus dem Orient, II, p. 66, which that author par-

tially describes, but does not figure. I cannot think Dr. Frass would have compared such a shell as this species with such forms as *Natica extensa* and *N. pungens* (Sow.), D'Orb., one of which has the form of a *Paludina*, and the other is apparently a true *Littorina* (see figures in Min. Conch., Pl. 31, fig. 2, and Trans. Geol. Soc., London, Vol. 4, 2d Ser., Pl. 18, fig. 5, Sowerby's original figures). I am much more inclined to think Dr. Frass had in mind when he wrote his description of *Natica olivæ*, a form like Hamlin's *Amauropsis Abeihensis*, many specimens of which correspond with Sowerby's figure of *N. extensa*. I therefore retain Dr. Hamlin's name *A. vafra*.

Genus TORNATELLA, *Lamarck.*

**Tornatella Abeihensis,** n. sp.

PLATE 11, FIGS. 8 AND 9.

Shell elongate or subfusiform, about 12 mm. high six across the body whorl; spire elevated, forming about half the height, the aperture being of equal height. Volutions five to six, but very moderately ventricose between sutures, the latter being very distinct and the top of the volution very narrowly shouldered. Aperture narrow; columellar lip with an elongated tooth-like fold, which is divided in the middle, but not as deeply as the space above and below. Surface marked by numerous impressed lines, which are obscurely punctate in the bottom.

This species is so nearly like many others, Cretaceous, Tertiary and recent, that I have not thought necessary to institute comparisons or make identifications.

*Locality.*—From the Abeih sandstone, at the Olive locality, near Abeih, Syria.

Genus ACTÆONELLA, *D'Orb.*

**Actæonella abbreviata,** Conrad's sp.

*Nerinea abbreviata*, Conrad, Off. Rept. Dead Sea, p. 233, App., Pl. 5, fig. 36.

? *Phasionella absalonis*, Frass, Aus dem Orient, I, p. 96, Pl. 1, fig. 3.

*Actæonella absalonis*, Frass, Ibid, II, p. 65, Pl. 6, fig. 9.—Blancken., Beitrage. zur Geol. Syriens, p. 117.

I see no reason why Conrad's specific name should not be retained for the above shell. The fact of there being a species *abbreviata* in the genus *Actæonina* should not throw out this form *Actæonella*, and certainly *Itieria* (*Nerinea*) *abbreviata*, Phil., can in no way be considered as a synonym, as indicated by Blanckenhorn; but even then the part of this shell having three distinct folds on the columella removes it entirely from these genera into that of *Triptycha*, Müller, and it should now stand as *Triptycha abbreviata*, Conrad's sp.

COLOSTRACON LEWISI, *Frass.*

**Colostracon Lewisi,** Frass sp., after Blanck.

*Colostracon curtum*, Hamlin, Mem. Mus. Comp. Zoöl., X, Pl. 3, fig. 4.
*Colostracon sinuatum*, Hamlin, Ibid, fig. 2.
*Colostracon Lewisi*, Frass, and *C. sinuatum*, Hamlin; Blanck. Bet. zur Geol. Syriens, p. 117.

The specimens of this shell in our collection show unquestionably that the three forms above cited are only varieties of the one species.

Genus TYLOSTOMA, *Sharpe.*

**Tylostoma Syriaca,** Conrad's sp.

*Chenopus Syriaca*, Con., Off. Rept. Lynch's Expl. Dead Sea, p. 220, Pl. 12, fig. 71.
*Tylostoma? Syriaca* (Conrad), Hamlin, Mem., p. 19, Pl. 1, fig. 6.
*Natica prælonga* (Desh.), Blanck., p. 104.

Comparing these specimens with D'Orbigney's figures of the *N. prælonga*, I should not think them the same. Moreover, the casts in our possession show very distinctly the periodic thickening of the shell which is characteristic of the genus *Tylostoma*, the supposed absence of which appears to have been the reason Dr. Blanckenhorn considered them identical with the French shell, which does not possess them. *T. Birdana*, Hamlin, *T. Gazellensis*, *T. Martini* and *T. triplica*, W., all show more or less distinctly this peculiarity. *T. gradata*, Haml., *T. indurata*, Conrad's sp., and *Globiconcha altispira*, W., do not show it.

### **Tylostoma Martini,** n. sp.

PLATE 11, FIGS. 6 AND 7.

Shell small, the height being about 15 mm., and the breadth of the body volution a little greater. Spire short, the apical angle being scarcely less than ninety degrees; volutions about six in number, very ventricose between sutures, the body whorl forming the great bulk of the shell. Aperture narrow, elongated, a little more than half as long as the shell; columellar lip callous and thickened, base rounded into the outer lip of the shell. Volutions with a strong varix at each half turn and flattened somewhat in the direction of the opposite diameter. Surface of the shell apparently smooth.

As compared with *T. Abeihensis*, Hamlin (Mem. Mus. Comp. Zoöl., Vol. 10, Pl. 1, fig. 4), this shell is very much smaller, more flattened laterally, with comparatively stronger varices and very much more ventricose volutions, the breadth being greater than the height, while the reverse is the case in that one.

*Locality.*—In the cherts of the Gazelle Mt. series, at Gurzûz, near Abeih, Syria. The specimen was presented by Dr. D. S. Martin, of New York city.

## Genus GLOBICONCHA, *D'Orb.*

### **Globiconcha (Tylostoma?) Gazellensis,** n. sp.

PLATE 11, FIGS. 1–3.

Shell small, the largest specimen out of quite a number having a vertical height of 19 mm. by a transverse diameter of 16 mm., while the height of the aperture is about 13 mm. General form of shell globular, or very broadly ovate, erect; volutions five or more in adult specimens, very ventricose between sutures, the outer one, as measured on the face of the shell, forming the great bulk of the whole, being 17 mm.; aperture oblique, widest below; outer lip thin; axis solid. Surface of the shell marked only by transverse lines of growth.

There is some difference among the different individuals in the elevation of the spire, as seen on half-grown specimens. Some of them having the sutures more deeply sunken and the two or three earlier volutions more pointed, while a few of them are very

slightly flattened or shouldered on the upper surface, in which case they present something of the form of *Natica orientalis*, Conrad (Lynch's Exped. Dead Sea, Pl. 5 of the Appendix, fig. 41), but the character of the axis will at once distinguish it from any *Natica*. The shell belongs to that section of the genus typified by *T. Fleuriausa*, D'Orb., as figured by Chenu in his Manuel Conch. et Palæont. Conch., p. 226, which differs from *Tylostoma* only in wanting the periodic varices.

*Locality.*—In the yellowish brown calcareous clays at the summit of Gazelle Mt., near Abeih, Syria.

### **Globiconcha altispira,** n. sp.

PLATE 11, FIGS. 4 AND 5.

Shell rather large, being 10 or 12 mm. in length, the body whorl very round and globose, while the inner whorls are more slender and the spire abruptly elevated from the top of the body whorl in a conical form, embracing an angle of from 45° to 60°, and the volutions flattened or bent very slightly convex between the sutures. Aperture semilunate and oblique, prolonged below at the base of the columella, forming a short broad canal. Columella straight, smooth and destitute of callus or folds. Judging from the shell substance left between the volutions of the casts when broken open, the shell must have been very thin and fragile. Surface unknown, but apparently smooth.

The distinguishing feature of this species is its very round and globular body whorl, below a narrow rapidly ascending conical spire of small dimensions; a combination of features not seen to so great an extent in any described form.

*Locality.*—At Ain Kisûr, near Abeih, Syria, in the upper layers of a brown clay-limestone, resting on the Bewerty clays.

### **Globiconcha? triplica,** n. sp.

PLATE 10, FIGS. 20–22.

Shell of about a medium size, wider than high, with a short spire composed of about six volutions within the body whorl. Volutions very ventricose, flattened on the top, or even channelled, and distinctly triangular from a vertical view, caused by

each of the three outer volutions having three very strong varices or periodic lips, resembling those of the genus *Triton.* These are not opposite each other on the several volutions, but a little in advance, while the space between the varices is somewhat flattened. The earlier volutions are regularly rounded and smooth. Aperture large, ovate, widest below and the lip thickened at this point. Collumellar lip slightly reflected and the axis distinctly umbilicated. Surface of the shell marked by transverse lines of growth, and under a glass by a few very fine spiral lines, most distinct on the flattened upper surface.

The strongly triangular aspect of this shell, as seen in a vertical view, is a very distinguishing character. There may be some question as to its correct reference to the genus *Globiconcha*, but it seems to possess all the essential features and none that are entirely opposed to those of that genus.

*Locality.*—In the cherts at Gazelle Hollow, near Abeih, Syria.

## LOPHOCERCIDÆ.

### Genus AKERA, *O. Muller.*

### **Akera siliciosa,** n. sp.

PLATE 10, FIGS. 14 AND 15.

Shell small or of medium size, the largest one observed measuring about 16 mm. in length, in the condition of an internal cast in chert. Form cylindrico-ventricose, the length across the aperture being about two-thirds as great as the height. Spire very short, but disclosing all the whorls, which are two and a half to three in number, rounded with distinct sutures; aperture very large, as long as the shell and broadly effuse at the base. Surface marked by obscure lines of growth and indistinct undulations.

One of the casts shows the columellar margin to have been very slightly thickened forming a distinct border.

*Locality.*—In the ferruginous cherts at Gurzûz, near Abeih, Syria; at the same horizon as the Gazelle Mt. cherts.

## EXPLANATION OF PLATE 4 A.

**Lima tenuitesta,** Whitf. Page 390.

*Figs.* 1 & 2. View of the right valve and of the hinge.

**Radula Naamansis,** Whitf. Page 390.

*Fig.* 3. View, twice enlarged, of a cast of a right valve.
*Fig.* 4. Similar view of a specimen preserving some of the shell.

**Gervillia obesa,** Whitf. Page 391.

*Figs.* 5–7. Right, left and anterior views of a typical form of the species.

**Perna Palestina,** Whitf. Page 394.

*Fig.* 8. Exterior of a right valve, one of the pair represented by fig. 9.
*Fig.* 9. Anterior profile of a pair of valves.
*Fig.* 10. Interior view of the valve fig. 8.

**Gervillia trapezoidalis,** Whitf. Page 392.

*Figs.* 11 & 12. Views of two right valves differing some in obliquity.

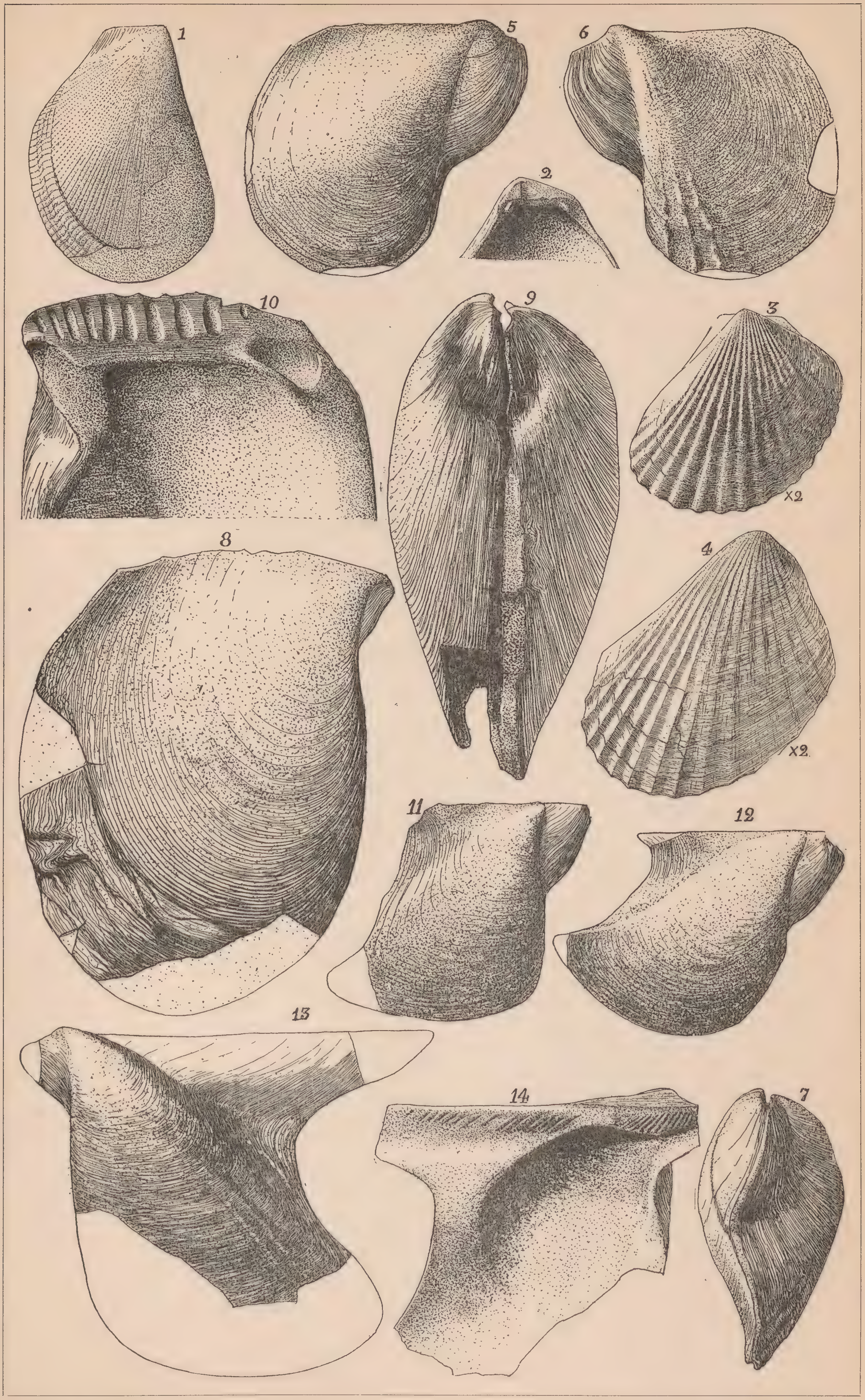
**Pterinoperna Syriaca,** Whitf. Page 393.

*Figs.* 13 & 14. Views of the opposite sides of the valve described, the latter showing the hinge.

# SYRIAN FOSSILS.

(Lamellibranchiata.)






Tappan Adney, del. H. C. Brown, Photo Eng.

## EXPLANATION OF PLATE 5.

**Trigonarca Palestina,** Whitf. Page 395.

*Figs.* 1 & 2. Lateral and cardinal views, three times enlarged, of one of the specimens described.

**Nucula glanstriticea,** Whitf. Page 396.

*Figs.* 3–5. Lateral, cardinal and interior views, four times enlarged, of different specimens.

**Gervillia perobesa,** Whitf. Page 392.

*Figs.* 6–8. Right, left and cardinal views of a large individual.

**Cardita Rawsoni,** Whitf. Page 397.

*Figs.* 9 & 10. Left side and cardinal views of an internal cast of the species.

**Opis megambona,** Whitf. Page 398.

*Figs.* 11 & 12. View of the left side, and anterior view of a slightly compressed specimen, enlarged. Fig. 12 shows the deep lunule.

**Platopis plicata,** Whitf. Page 400.

*Figs.* 13 & 14. Left and cardinal views, twice enlarged, of a perfect shell, the largest obtained.

*Fig.* 15. View, twice enlarged, of the interior of a right valve, showing the hinge structure.

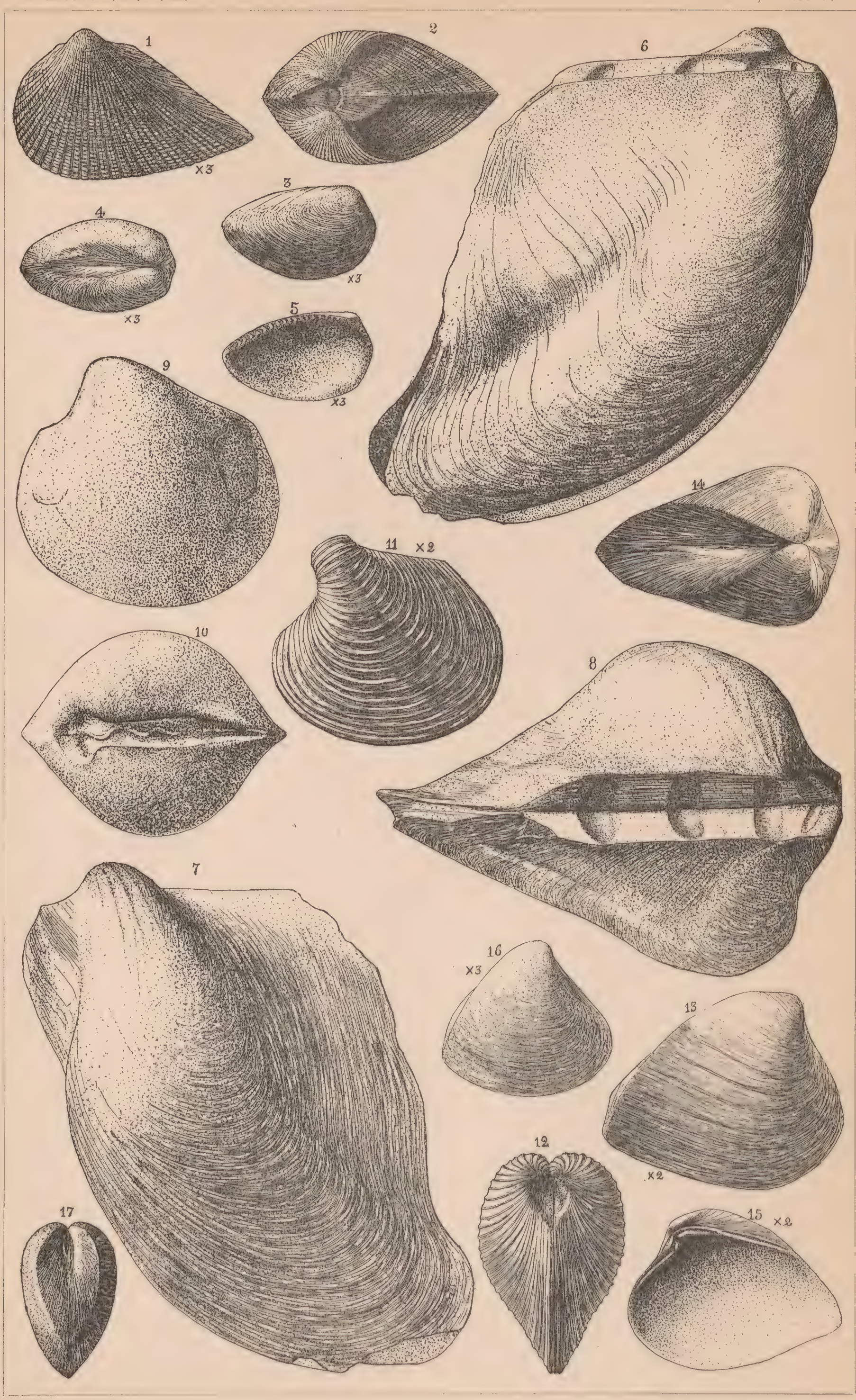
**Platopis ? triangularis,** Whitf. Page 401.

*Figs.* 16 & 17. Right and cardinal views of a specimen enlarged three times.

# SYRIAN FOSSILS.

(Lamellibranchiata.)






Tappan Adney, del. H. C. Brown, Photo Eng.

## EXPLANATION OF PLATE 6.

**Scambula secunda**, Whitf. Page 402.

*Fig.* 1. View of the right side of a shell, two diameters.

**Eriphyla crenulicosta**, Whitf. Page 403.

*Figs.* 2 & 3. Left and cardinal views, four diameters, of a very perfect shell.

*Figs.* 4 & 5. Views of the hinge of opposite valves of the species, four diameters.

**Lucina percancellata**, Whitf. Page 403.

*Fig.* 6. Lateral view of a specimen, four diameters.

**Cardium (Protocardium ?) Birdanum**, Whitf. Page 405.

*Fig.* 7. Right side of a specimen.

*Fig.* 8. Anterior view of another shell, showing a strong callus beneath the beaks.

*Fig.* 9. View of a larger, somewhat flattened valve.

*Fig.* 10. Cardinal view of specimen fig. 7, showing the valves somewhat displaced.

**Cardium (Serripes ?) Bewertense**, Whitf. Page 404.

*Figs.* 11 & 12. Two views of an entire specimen, showing the true rotundity.

*Fig.* 13. A larger left valve, showing the hinge.

*Fig.* 14. Interior of a right valve, two diameters, from the Duccûn beds.

**Trapezium Naamanense**, Whitf. Page 406.

*Figs.* 15 & 16. Right and cardinal views, three diameters, of a cast of the species.

**Corbicula (Batissa ?) Hamlini**, Whitf. Page 407.

*Figs.* 17 & 18. Two views of an elongated example, probably somewhat vertically distorted.

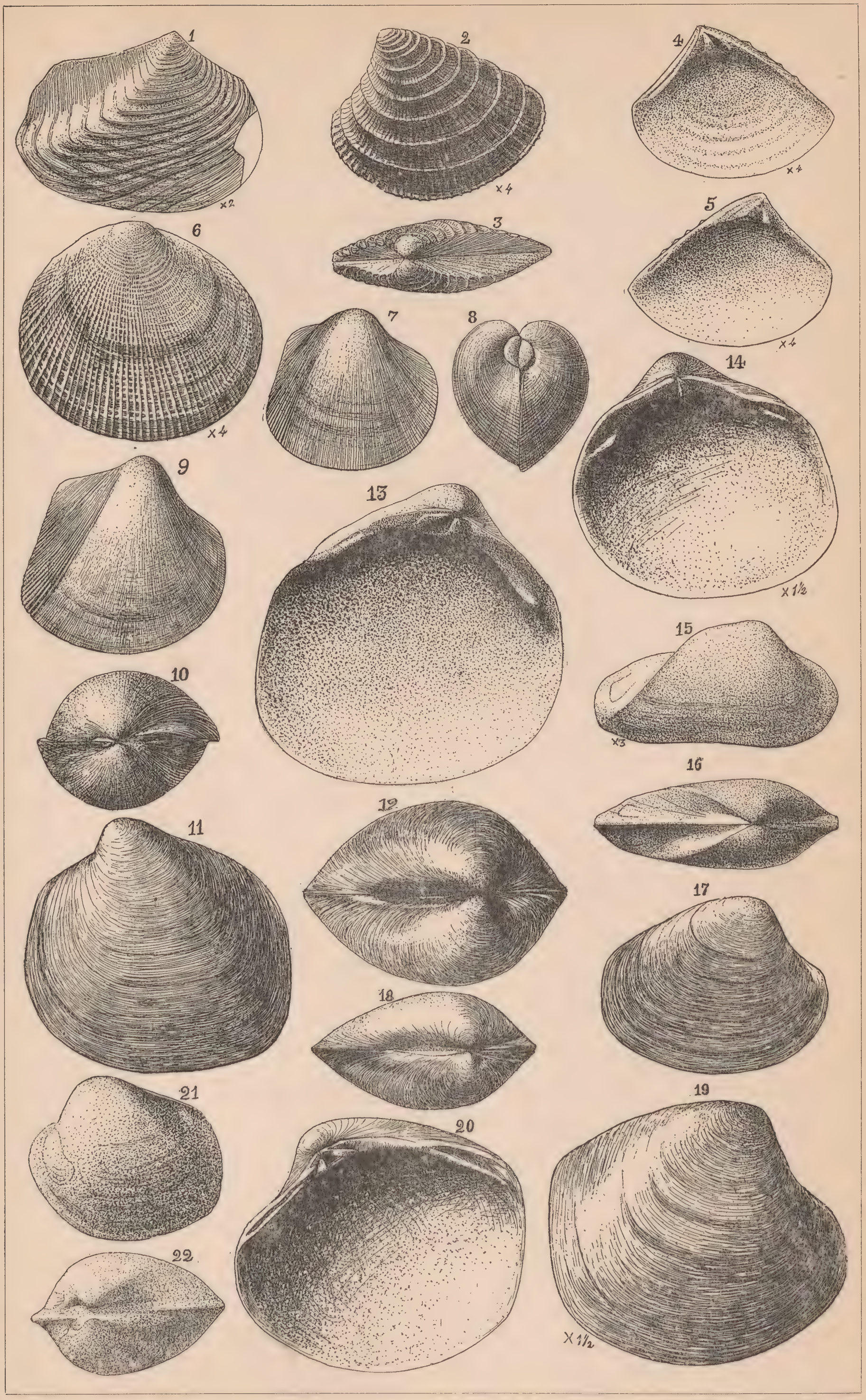
*Figs.* 19 & 20. Exterior and inner views of a valve of quadrangular form, one and a half diameters.

*Figs.* 21 & 22. Two views of an internal cast of this species.

# SYRIAN FOSSILS.

(Lamellibranchiata.)



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## EXPLANATION OF PLATE 7.

**Veleda elliptica,** Whitf. Page 406.

*Figs.* 1 & 2. Right and cardinal views, one and a half diameters, of the most perfect specimen seen.

**Corbiculopsis Birdi,** Whitf. Page 409

*Figs.* 3 & 4. Two views of a small shell of perfect form.
*Fig.* 5. Right valve of a larger specimen.
*Figs.* 6 & 7. Hinge views of opposite valves, showing the generic features described.

**Arcopagia planissima,** Whitf. Page 409.

*Figs.* 8 & 9. Lateral and cardinal views of a cast of the species.

**Caryatis globulus,** Whitf. Page 410.

*Figs.* 10 & 11. Two views of a specimen of ordinary form and size.

**Donax minutissimus,** Whitf. Page 411.

*Figs.* 12 & 13. Two views of the type specimen, three diameters.

**Callista Syriaca,** Whitf. Page 411.

*Figs.* 14 & 15. Two views of a cast of the usual form.

**Mactra? Olivensis,** Whitf. Page 412.

*Figs.* 16 & 17. Two views of the largest specimen, two diameters.

**Anatina? orientalis,** Whitf. Page 412.

*Fig.* 18. View of a shell as it lies in the rock.

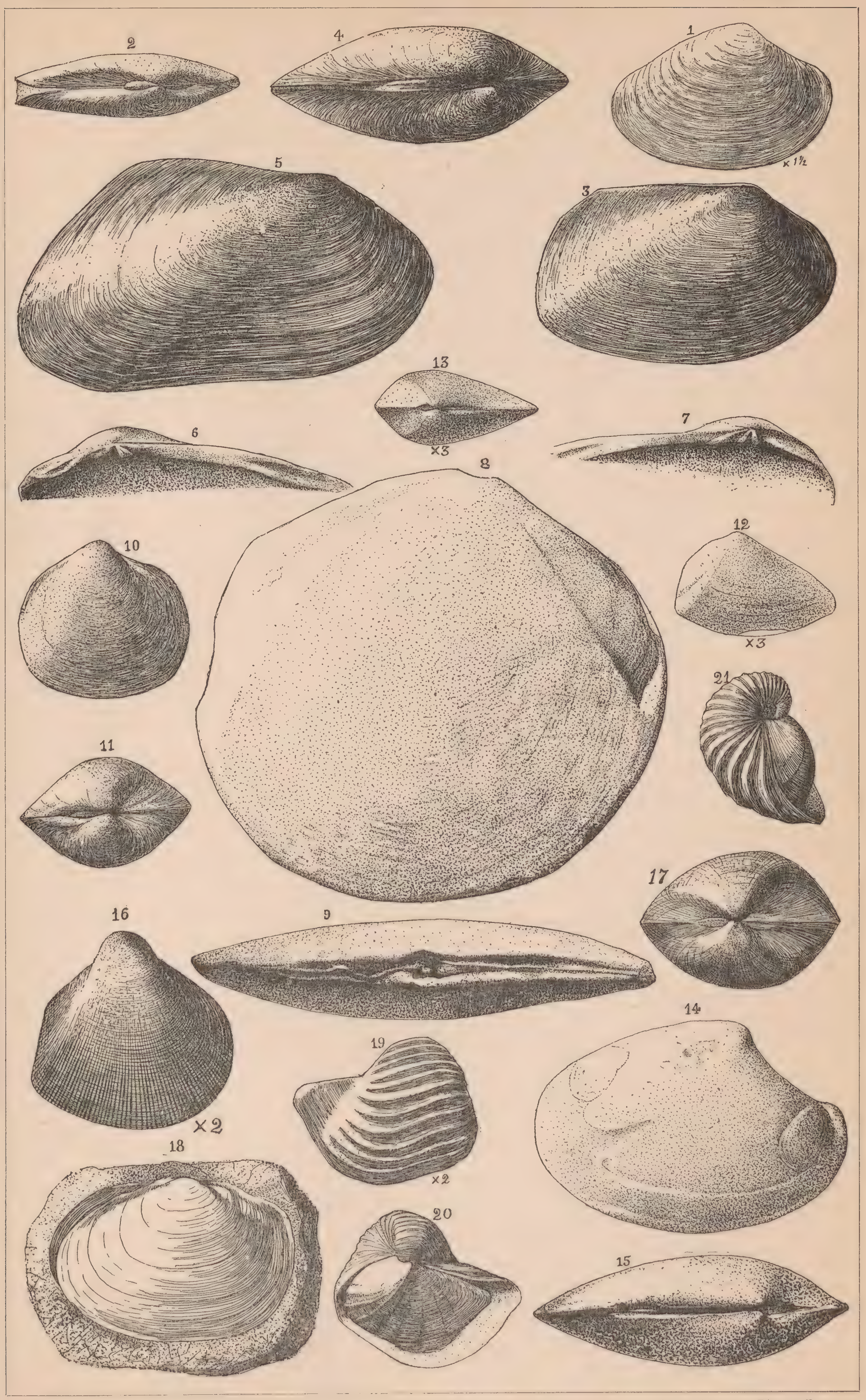
**Corbula olivæ,** Whitf. Page 413.

*Figs.* 19–21. Three views of a very perfect shell, two diameters, showing the features of the species.

# SYRIAN FOSSILS.

(Lamellibranchiata.)



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## EXPLANATION OF PLATE 8.

**Caricella planilirata,** Whitf. Page 414.

*Figs.* 1 & 2. Front and back views of the specimen described.

**Volutomorpha? orientalis,** Whitf. Page 414.

*Figs.* 3 & 4. Opposite sides of one of the specimens, twice enlarged.

**Mangelia? solitaria,** Whitf. Page 415.

*Fig.* 5. Front view, showing the aperture, three diameters.

*Fig.* 6. Lateral view, showing the slit in the lip.

**Strombus crassaliratus,** Whitf. Page 416.

*Fig.* 7. Front view of the specimen.

**Natica (Ampullina) fluctuoides** Whitf. Page 417.

*Fig.* 8. Back view, twice enlarged, of the largest specimen observed. The lines crossing the shell are deep brown in color.

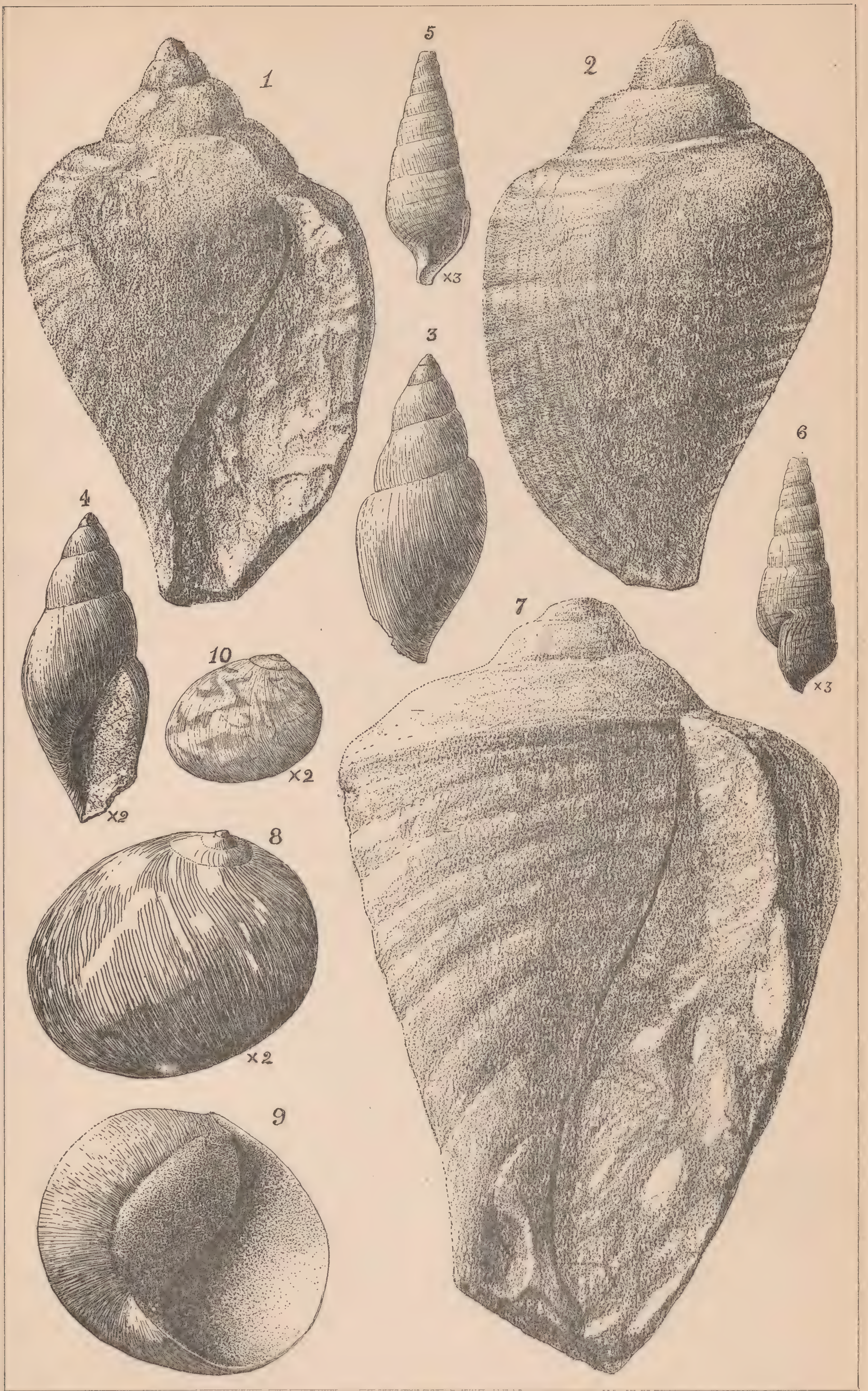
*Fig.* 9. View of the aperture, showing the callus and lip.

*Fig.* 10. View of a specimen of the small variety from the Olive locality, near Abeih, showing zigzag color markings. Twice enlarged.

# SYRIAN FOSSILS.

(Gasteropoda.)



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## EXPLANATION OF PLATE 9.

**Natica (Ampullina) fluctuoides**, var. **acuminata,** W. Page 418.

*Figs.* 1 & 2. Front and back views of the shell, showing the pointed apex.

**Neverita patula,** Whitf. Page 419.

*Figs.* 3 & 4. Top and basal views of a specimen, showing the form and callus. Fig. 3 shows the color markings, x 2.

**Natica (Ampullina) minima,** Whitf. Page 418.

*Figs.* 5 & 6. Back and front views, three times enlarged, of a specimen which shows the color bands and zigzag markings.

**Scalaria novemvaricosa,** Whitf. Page 422.

*Fig.* 7. View, twice enlarged, of a specimen showing all the features except the aperture.

**Scalaria Bewertensis,** Whitf. Page 421.

*Figs.* 8 & 9. Similar views, three times enlarged, of two specimens which vary in the number of varices.

**Mesalia Gazellensis,** Whitf. Page 424.

*Fig.* 10. View of a shell, three times enlarged.

**Cerithium Conradi,** Whitf. Page 428.

*Figs.* 11 & 12. Views, one and one-half diameters, of two different individuals, showing the prevailing features.

**Odostomopsis Abeihensis,** Blanckenhorn's sp. Page 425.

*Figs.* 13 & 14. Front and back views of a specimen of medium size of *Phasianella abeihensis*, Blanck., which is the type of the new genus Odostomopsis, Whitf.

**Tubulostium rugosum,** Whitf. Page 424.

*Figs.* 15 & 16. Lateral and back views, twice enlarged, of a specimen, showing the prevailing features.

**Vertagus coloratus,** Whitf. Page 429.

*Figs.* 17 & 18. Views, one and one-half diameters, of two specimens, showing variations in degree of increase and in surface markings. The aperture in fig. 17 is laterally crushed, and in fig. 18 is partially restored from other examples. The dark spiral lines are the color lines.

**Potamides distortus,** Whitf. Page 429.

*Figs.* 19 & 20. Front and back views, one and one-half diameters, of different specimens, showing general form.

*Fig.* 21. View of the last volution of a shell, one and one-half diameters, showing stronger plications.

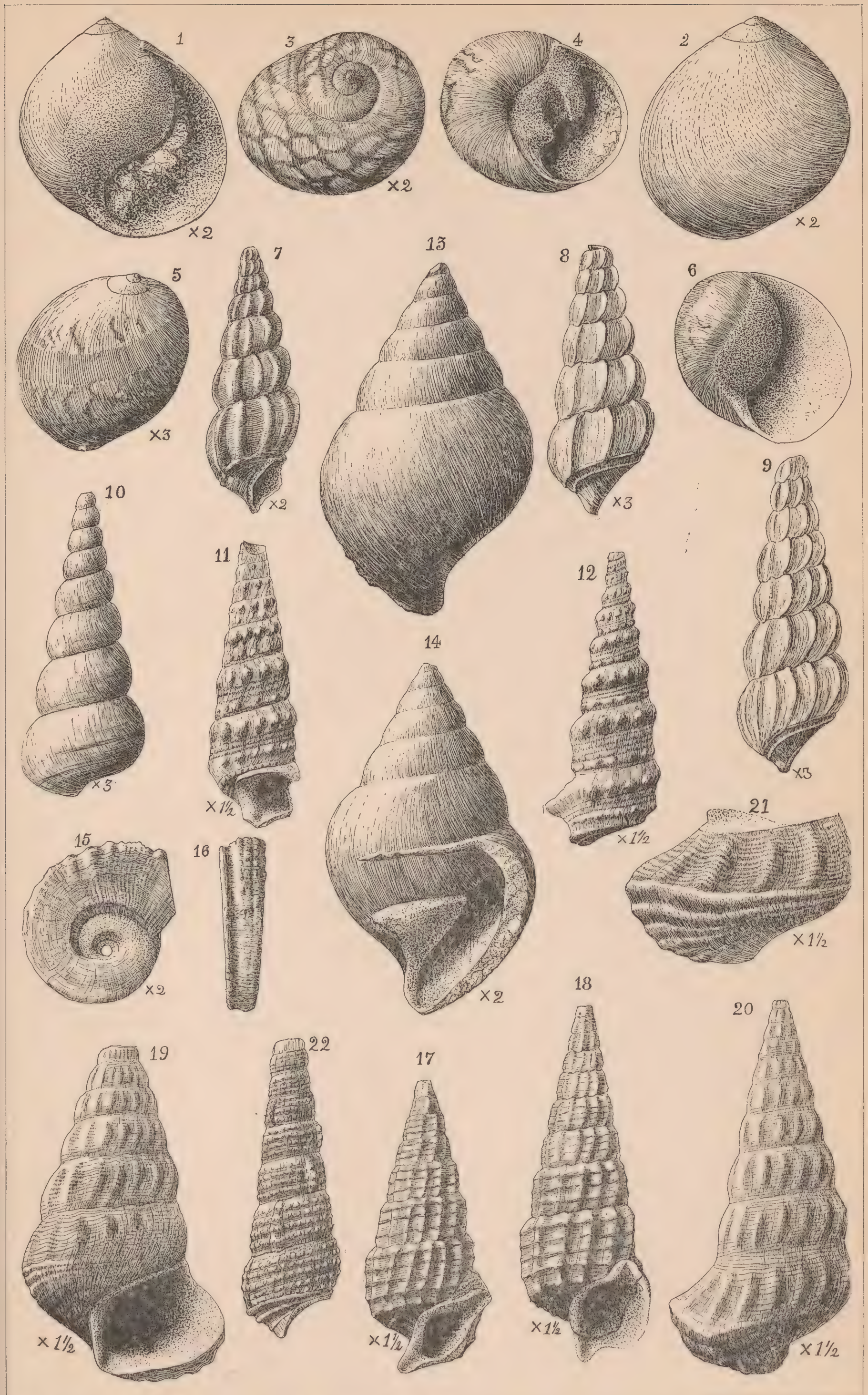
**Cerithiopsis cretacea,** Whitf. Page 431.

*Fig.* 22. Lateral view of the specimen described, enlarged three diameters.

# SYRIAN FOSSILS.

(Gasteropoda.)



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## EXPLANATION OF PLATE 10.

**Nerita Abeihensis,** Whitf. Page 431.

*Figs.* 1 & 2. View of the aperture, and of the back of a typical specimen, four diameters.

**Nerita bidens,** Whitf. Page 432.

*Figs.* 3 & 4. Two views, four diameters, of the largest specimen observed.

*Fig.* 5. Back view, four diameters, of a smaller shell, showing the angular volution in the young stages.

**Nerita pagoda,** Whitf. Page 432.

*Fig.* 6. Back view of shell, four diameters, showing the prevailing features.

*Figs.* 7 & 8. Two views of a larger specimen, four diameters.

**Trochus striatofundus** Whitf. Page 433.

*Figs.* 9 & 10. Two views of the largest example seen, showing the prevailing features.

*Fig.* 11. Front view of a second specimen. All enlarged four times.

**Monodonta antiqua,** Whitf. Page 434.

*Figs.* 12 & 13. Lateral and basal views of a very perfect shell, four diameters.

**Akera siliciosa,** Whitf. Page 441.

*Fig.* 14. Front view of a medium sized example.

*Fig.* 15. Back view of a larger examples, both casts, both two diameters.

**Philine (Megistostoma) patula,** Whitf. Page 434.

*Figs.* 16 & 17. Back and front views of the specimen described enlarged one and one-half diameters.

**Actæonina Marahhensis,** Whitf. Page 436.

*Figs.* 18 & 19. Two views of the best cast, the apex of which has been broken in the matrix.

**Globiconcha triplica,** Whitf. Page 440.

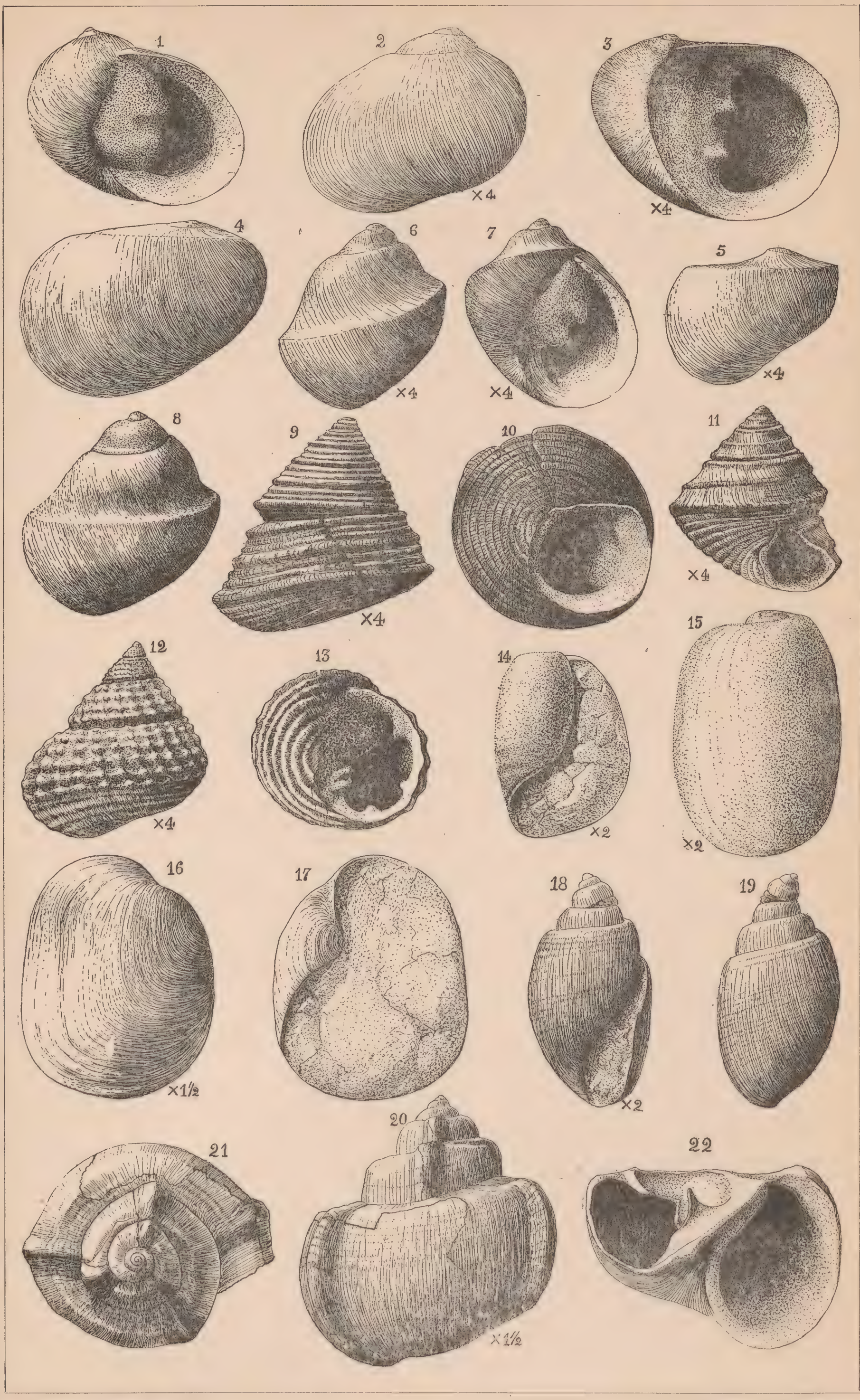
*Figs.* 20 & 21. Lateral and vertical views of an imperfect silicified specimen, one and one-half diameters, and partially restored.

*Fig.* 22. View of the aperture, as shown by another imperfect shell, one and one-half diameters.

# SYRIAN FOSSILS.

(Gasteropoda.)



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## EXPLANATION OF PLATE 11.

**Globiconcha (Tylostoma) Gazellensis,** Whitf. Page 439.

*Fig.* 1. Front view of a young specimen, two diameters.
*Figs.* 2 & 3. Two views of a large example, two diameters.

**Globiconcha altispira,** Whitf. Page 440.

*Figs.* 4 & 5. Opposite views of two specimens which vary slightly in the height of the spire. Natural size.

**Tylostoma Martini,** Whitf. Page 439.

*Figs.* 6 & 7. Front and vertical views of the specimen described, twice enlarged.

**Tornatella Abeihensis,** Whitf. Page 437.

*Figs.* 8 & 9. Front and back views, twice enlarged, of the type specimen, which is slightly imperfect.

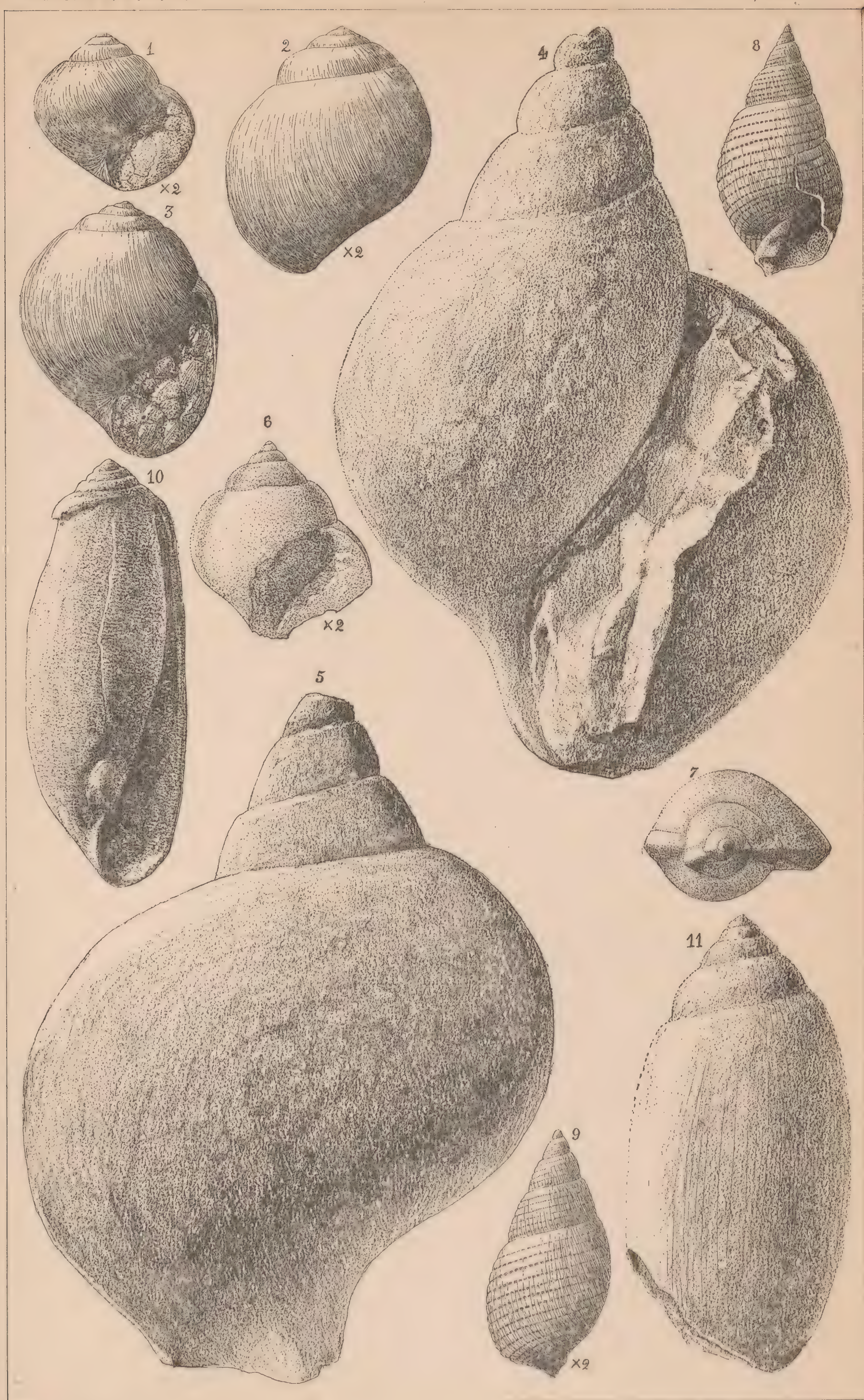
**Actæonina Syriaca,** Whitf. Page 435.

*Fig.* 10. Front view of a specimen, natural size, crushed in the upper part.
*Fig.* 11. View of a much larger imperfect specimen.

# SYRIAN FOSSILS.

(Gasteropoda.)



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# Index to Volume III.


PAGE

Accipiter atricapillus..127, 135, 156
" striatulus.. 127
cooperi.....135, 156
velox.....135, 156
Actæonella abbreviata..... 437
absalonis.....389, 437
salomonis..... 389
Actæonina marahhensis..... 436
syriaca .....389, 435
vafra .....389, 436
Actitis macularia.....133, 318, 327
Æchmophorus occidentalis..... 129
Ægialitis meloda..... 327
vocifera ..... 133
wilsonia.....321, 327
Agelaius cyanopus..... 379
Aix sponsa.....131, 155, 328
Ajaja ajaja.....318, 320
Akera siliciosa .....389, 441
Alaria monodactyla.....387, 417
Amauropsis abeihensis .....387, 421
gradata..... 420
subcanaliculata.....389, 420
Amblycercus solitarius..... 379
Ammodramus caudacutus nelsoni, 323, 328
lecontei.....323, 328
manimbe..... 374
maritimus peninsulæ....324, 328
" sennetti.....323, 328
sandwichensis.....128, 144, 157
" alaudinus .... 128, 144, 157
Ampelis cedrorum.....149, 157
Ampullina fluctuoides.....387, 417
" var. acuminata 387, 418
minima.....387, 418

PAGE

Anas boschas.....130, 155
carolinensis.....131, 155
fulvigula maculosa.....320, 327
Anatina orientalis .....386, 412
Anchura petrosa..... 387
Anser albifrons canadensis..131, 156
Anthus pensilvanicus.....151, 158
pœcilopterus.....199, 201
rufus..... 344
Antrostomus carolinensis ..... 328
Antrozous pallidus.....176, 221
Aphobus chopi ..... 379
megistus ..... 379
Aporrhais pleurotomoides...387, 416
Aquila chrysaëtos.....135, 328
Arbelorhina cyanea..... 347
Arca brevifrons..... 384
indurata ..... 384
longa..... 384
orientalis..... 384
oviformis ..... 384
syriaca ..... 384
Arcopagia planissima.....386, 409
Ardea herodias..... 131
Arremon polionotus ..... 362
silens..... 362
Artibeus carpolegus....173, 181, 205
coryi ..... 173
jamaicensis.....173, 181
perspicillatus.....170, 181
Asaphus canalis.....7, 16, 17
Asio accipitrinus.....136, 156
Arvicola emmonsi..... 297
texiana..... 287
(Chilotus) oregoni..... 168
(Myonomes) riparius..... 168
Astarte engonata..... 385
lintea..... 385

PAGE

Astarte lucinoides..... 385
orientalis..... 385
subcordata..... 401
Atalapha cinerea..... 177
frantzii..... 177
Ateles geoffroyi ..... 204
vellerosus..... 176
Atticora cyanoleuca..... 346
fucata..... 346
Avocet, American.....317, 321
Aythya americana.....131, 328
vallisneria..... 328

BARTRAMIA longicauda.....318, 321
Basileuterus flaveolus ..... 345
hypoleucus..... 344
leucophrys..... 345
Bathyurus extans..... 7
quadratus..... 16
seelyi..... 37
Bittern, American ..... 131
Blackbird, Brewer's..... 143
Blarina costaricensis..... 205
Bluebird, Mountain..... 155
Western..... 155
Bolbocephalus seelyi..... 37
? truncatus ..... 37
Bonasa umbellus sabini..127, 134, 156
" togata..127, 134, 156
" umbelloides .... 127
Botaurus lentiginosus.....131, 327
Bubo virginianus saturatus..... 127
" subarcticus....
127, 136, 156
Brachyramphus marmoratus, 130, 155
Bradypus castaneiceps..... 216
griseus ..... 216
Branta canadensis hutchinsi..... 320
Bucania tripla ..... 7, 20
Buffle-head. ..... 131
Bunting, Lazuli ..... 148
Buteo borealis..... 322
calurus.....128, 135
lineatus.....322, 327

CALAUROPS lituiformis..... 26

PAGE

Callista syriaca.....386, 411
(Cyprina) abeihensis..... 386
Calliste cayana.... ..... 352
flava..... 352
margaritæ ..... 351
Calymene blumenbachii..... 14
multicostata ..... 22
Campylorhynchus unicolor..... 343
Cancellaria petrosa ..... 387
Canis latrans..... 219
Capromys brachyurus..329, 332, 336
" thoracatus..
329, 332, 336
ingrahami..... 329
melanurus..... 336
pilorides..... 336
prehensilis..... 336
Cardinal, Gray-tailed..... 324
Texas..... 316
Cardinalis cardinalis..... 324
" canicaudus.. 324
" coccineus.... 325
" superbus ... 325
Cardita lacunar..... 385
rawsoni.....385, 397
subrotundata..... 385
Cardium bellum... ..... 404
hillanum, var. moabitica ... 404
(Acanthocardium) crebriechinatum ..... 385
(Protocardium) bellum..... 385
" birdanum, 385, 405
" hillanum ..... 385
" judiacum .... 385
(Serripes ?) bewertensis..386, 404
Caricella planilirata.....387, 414
Carollia brevicauda ..... 204
Carpodacus purpureus ..... 128
" californicus,
128, 143, 157
Caryates globulus.....386, 410
Cassicus persicus ..... 377
Catbird..... 152
Cathartes aura..... 134
Catostomus commersoni ..... 117
Cebus hypoleucus..... 204

PAGE
Ceophlœus pileatus.....139, 156
Cercoleptes caudivolvus..... 204
Cerithiopsis cretacea .....388, 431
Cerithium acuticostatum..... 388
æquicostatum ..... .... 388
bilineatum.....388, 425, 428
conradi..... ...388, 428
excavatum ..... ..... 388
libanoticum.....388, 427
magnicostatum....388, 427, 429
Certhia familiaris montana..... 128
" occidentalis ...
128, 133, 158
Certhiola chloropyga..... 348
Ceryle americana... .....136, 156
cabanisi..... ..... 328
Chætura cinereiventris..... 201
pelagica.....318, 328
Charadrius squatarola. .. ..... 327
Charitonetta albeola.....131, 155
Chelidon erythrogaster.....
149, 157, 318, 328
Chemnitzia syriaca..... 387
Chenopus induratus.....389, 420
syriaca .. ... .....389, 438
Chickadee, Chestnut-backed..... 153
Long-tailed..... ..... 153
Mountain... ..... 153
Oregon..... 153
Chickaree..... ... ..... 41
Chipmunk, Arizona... ..... 94
Buff-bellied..... 101
Colorado..... 97
Columbian ..... 103
Desert..... 115
Gila..... 68
Klamath..... ..... 90
Lake Superior ..... 106
Long-eared ..... ..... 78
Lower California..... 70
Merriam's ..... 84
Mexican..... ..... 92
Northern..... ..... 107
Pale..... ..... 110
Redwood..... 75
Sacramento.. ..... .... 80

PAGE
Chipmunk, San Bernardino..... 86
San Pedro..... 99
Siberian..... 71
Sierra Nevada..... 88
Townsend's..... 72
Uintah..... 96
Wahsatch..... 112
Cholœpus hoffmanni..... 217
Chordeiles virginianus.....129, 140
" henryi....
129, 318, 328
Cidarites glandarius ..... 383
Cinclus mexicanus..... 151
Circus hudsonius .....134, 156
Cistothorus palustris..... 327
paludicola .....152, 158
stellaris .....327, 328
Coccothraustes vespertinus montanus .....143, 157
Coccyzus americanus...128, 136, 318
Cock, Chapparal.....316, 317
Cœlogenys paca..... 216
Cœreba cyanea..... ..... 347
chloropyga....,..... 348
Colaptes auratus..311, 314, 323, 328
cafer.....127, 139, 156
" saturatior....127, 139, 156
campestris ..... ..312, 313
chrysoides ... ..... 313
mexicanoides..... 313
Colostracon curtum..... ..... 438
lewisi.....389, 438
sinuatum..... 438
Columba fasciata .....134, 156
Columnaria alveolata..... 27
Colymbus holbœlli.....129, 155
Compsothlypis pitiayuma..... 344
Conepatus marpurito..... 204
Contopus borealis.....140, 157
richardsoni.....141, 157
virens .....318, 328
Corbicula (Batissa?) hamlini..386, 407
Corbiculopsis birdi.....386, 409
Corbula abeihensis..:..... 385
aligera..... 386
congesta..... 386

PAGE
Corbula neæroides . . . . . 386
olivæ . . . . . 386, 413
sublineolata . . . . . 386
Cormorant, Mexican . . . . . 317
Violet-green . . . . . 130
Corvus americanus . . . . . 142, 157
caurinus . . . . . 128, 142, 157
Coryphospingus cristatus . . . . . 370
cucullata . . . . . 370
Coryphospiza melanotis . . . . . 375
Crane, Little Brown . . . . . 131
Crassatella zitteliana . . . . . 399
Creeper, California . . . . . 153
Crossbill, American . . . . . 143
Crow, American . . . . . 142
Northwest . . . . . 142
Crymophilus fulicarius . . . . . 132, 156
Cryptoplocus libanensis . . . . 388, 427
Cryptozoön steeli . . . . . 6, 23
Cuckoo, Yellow-billed . . . . . 136
Cucullæa parallela . . . . . 384
Cuniculus bahamensis . . . . . 333
Cyanocitta litoralis . . . . . 141
stelleri . . . . . 127, 141, 157
" annectens . . 127, 141, 157
Cyanocorax chilensis . . . . . 379
chrysops . . . . . 380
cyanomelas . . . . . 379
nigriceps . . . . . 380
Cyclorhis viridis . . . . . 339, 346
Cyclothurus didactylus . . . . . 217
Cymella (Pholadomya ?) vignesi . . 386
Cypselus acutus . . . . . 201
Cypsnagra ruficollis . . . . . 360
Cyrtoceras boycii . . . . . 22, 26
Cytherea indurata . . . . . 386
libanotica . . . . . 386
syriaca . . . . . 386

DACNIS cayana . . . . . 347
speciosa . . . . . 346
Dendragopus franklini . . . . . 127
obscurus fuliginosus . . . . . 127, 133, 156
obscurus richardsoni . . . . . 127, 133, 156

PAGE
Dendroica æstiva . . 150, 157, 318, 328
auduboni . . . . . 150, 157
coronata . . . . . 150, 157
pensylvanica . . . . . 318, 328
nigrescens . . . . . 128, 151, 158
townsendi . . . . . 128, 151, 158
virens . . . . . 318
Dentalium cretaceum . . . . . 389
Dicotyles tajacu . . . . . 220
Dickcissel . . . . . 326
Didelphys marsupialis aurita . . . . 217
virginiana californica . . . . . 228
(Metachirus) quica . . . . . 217
(Micoureus) cinerea . . . . . 218
" murina . . . . . 190, 218
(Philander) lanigera . . . . . 218
Dipodomys agilis . . . . . 273
" compactus . . . . . 274
ambiguus . . . . . 274
californicus . . . . . 274
chapmani . . . . . 274
deserti . . . . . 274, 279, 280
heermanni . . . . . 273, 274
merriami . . . . . 274
montanus . . . . . 273, 274
ordii . . . . . 273
phillipsii . . . . . 272
spectabilis . . . . . 274
wagneri . . . . . 273, 274
Dipodops agilis . . . . . 274, 279, 280
chapmani . . . . . 274
compactus . . . . . 226, 274
longipes . . . . . 273, 274
ordii . . . . . 226, 273, 274
" palmeri . . . . . 276
richardsoni . . . . . 277, 280
sennetti . . . . . 226, 274
Dipper, American . . . . . 151
Diucopis fasciata . . . . . 366
Dolychonyx oryzivorus . . . . . 379
Donacobius atricapillus . . . . . 343
Donax minutissimus . . . . . 386, 411
Dosinia forgemolli . . . . . 386
Dowitcher, Long-billed . . . . . 132
Dove, Band-tailed . . . . . 134
Drillia pleurotomoides . . . . . 387

PAGE

Duck, Buffel-head..... 131
Shoveller.....317, 320
Spotted.....317, 320
Wood..... 131
Dryobates pubescens..... ... 127
" gairdneri....
127, 138, 156
" oreœcus, 138, 156
villosus harrisi.....127, 137, 156
" hyloscopus..... 127
" leucomelas, 127, 136, 156

EAGLE, Bald ..... ..... 135
Golden..... ... 135
Ecculiomphalus triangulus..... 29
Egret, Great White..... 317
Snowy..... 317
Elanoides forficatus..... 318
Elanus leucurus.....322, 327
Emberiza pileata ..... ..... 373
Embernagra rufivirgata.....326, 328
Emberizoides macrourus herbicola, 375
Empidonax difficilis....128, 141, 157
hammondi.....141, 157
minimus..... ..... 328
pusillus trailli.....141, 157
Erethizon epizanthus..... 168
Ereunetes occidentalis..132, 156, 327
pusillus.....132, 156, 321, 327
Eriphyla cranulicosta..... 403
crenulicosta.... ..... 385
Eucometis albicollis... .... ... 358
Eunema bicarinata .....422, 423
Euomphalus perkinsi..... 30
Euphonia chlorotica violaceicollis, 350
crassirostris ..... 351
laniirostris ..... 351
Euscarthmus ochropterus..... 339
Exogyra africana..... 384
flabellata..... .... 384

FALCO columbarius.....
127, 135, 156, 327
columbarius suckleyi ..... 127
sparverius..... ...135, 156
peregrinus anatum.....127, 135
" pealei ..... 127

PAGE

Felis eyra..... 310
onca ..... ..... 176
pardalis .....176, 204
tigrina... ..... 176
yaguarundi ..... 176
Fiber zibethicus..... 168
Finch, California Purple ..... 143
Lark..... 317
Nelson's Sharp-tailed...317, 323
Texan Seaside.....317, 323
Flicker, Golden-fronted..... 317
Golden-winged..... 323
Northwestern..... 139
Red-shafted..... 139
Flycatcher, Hammond's..... 141
Olive-sided..... 140
Scissor-tailed..... 317
Traill's..... ..... 141
Vermilion..... 323
Western ..... ..... .. 141
Formicarius myiotherinus..... 199
Formicivora ardesiaca..... 199
Fossarius neritopsoides..... 388
Fregata aquila..... 327
Fringilla cristata..... ..... 370
cucullata..... 370
matutina.. .... ..... 373
Fulica americana..... 327
Fulmar, Pacific..... 130
Fulmarus glacialis glupischa..130, 155
Fusus bhamdunensis..... 387

GALEOSCOPTES carolinensis..129, 152
Galictis barbara..... 204
Gallinago delicata.....132, 156, 328
Geobates pœcilopterus..... 201
Geomys personatus..... 224
Geothlypis formosa.....318, 328
macgillivrayi.....151, 158
trichas occidentalis.....151, 158
velata..... 344
Gervillia obesa.....384, 381
perobesa..... .....384, 392
trapezoidalis.....384, 392
Glaucidium gnoma californicus..
128, 136, 156

PAGE

Glaucionetta clangula americana.. 328
Glauconia abeihensis..... 387
geibeli..... 423
trechi..... 423
Globiconcha altispira...387, 438, 440
? triplica..... 440
Glossophaga soricina..... 204
Gomphoceras minimum..... 16
Gonodon ? hebes..... 386
Goose, Hutchins's..... 320
American White-fronted.... 131
Goshawk, American..... 135
Grackle, Great-tailed..... 317
Graptolithus pristis..... 14
Grebe, Holbœll's..... 129
Western..... 129
Grosbeak, Black-headed..... 148
Western Evening..... 143
Grouse, Canadian Ruffed..... 134
Columbian Sharp-tailed..... 134
Oregon Ruffed..... 134
Richardson's..... 133
Sooty..... 133
Grus americana..... 328
canadensis.....131, 156
mexicana..... 328
Guiraca cærulea.....318, 328
cyanea..... 368
Gull, Bonaparte's..... 130
California..... 130
Glaucous-winged..... 130
Franklin's..... 319
Heermann's..... 130
Herring..... 317
Ring-billed..... 317
Short-billed..... 130
Western..... 130
Gryphæa capuloides..... 384
Gyrodes orientalis..... 387

HABIA melanocephala..128, 148, 157
Hæmatopus palliatus..... 328
Haliæëtus leucocephalus....135, 327
Harporhynchus rufus..... 328
Hawk, American Sparrow..... 135
Cooper's..... 135

PAGE

Hawk, Duck..... 135
Harris's.....317, 322
Marsh..... 134
Pigeon..... 135
Red-shouldered..... 322
Red-tailed..... 322
Sharp-shinned..... 135
Western Red-tailed..... 135
Helicotoma similis..... 31
Helminthophila celata.....
128, 150, 157, 318
celata lutescens....128, 150, 127
peregrina.....318, 328
pinus..... 318
Heron, Great Blue.....131, 317
Hesperocichla nævia.....155, 158
Hesperomys aureolus..... 212
aztecus..... 187
fulvescens..... 212
indianus..... 390
leucopus..... 297
" austerus..... 167
" sonoriensis.....
187, 211, 302, 305
" texanus..... 305
deserticolus..... 302
nebracensis..... 304
rufinus.....302, 305
melanophrys.....175, 187
sonoriensis.....302, 304
texanus..... 304
(Habothrix) caliginosus..... 210
" teguina..... 208
(Nictomys) sumichrasti..... 187
(Oryzomys) alfaroi..... 214
(Tylomys) nudicaudus..... 210
(Vesperimus) americanus.... 297
" cherrii..... 211
" leucopus..... 296
" nudipes..... 213
Heteromys adspersus..... 270
albolimbatus.....268, 272
alleni..... 268
anomalus.....269, 270
bicolor..... 270
desmarestianus....268, 269, 270

PAGE
Heteromys irroratus.....268, 270
longicaudatus, 215, 268, 271, 272
melanoleucus ..... 269
Hippurites lewisi ..... ..... 385
liratus ..... ..... 385
plicatus..... 385
Hirundo erythrogastra..... 346
Histiotis macrotus .. ..... 197
maculatus ..... 195
velatus :..... 197
Holopea arenaria..... 16
cassina.... .....16, 17
Hootie..... 331
Hummingbird, Rufous..... 140
Hutia..... ..... 331
Hypocnemis myiotherina ..... 199

ICTERIA virens .....318, 328
Icterus bullocki.....143, 157, 318
croconotus ..... 378
galbula .....318, 328
pyrrhopterus ..... ..... 378
spurius.... ..... 318
Ictinia mississippiensis, 318, 322, 327
Idonearca oviformis..... 384
syriaca..... 384
Illænus crassicauda..... 22
Inoceramus lynchi.....384, 394
Isocardia merilli..... 386

JAY, Black-headed..... 141
Steller's..... 141
Junco hyemalis oregonus.....
128, 145, 157
hyemalis shufeldti..128, 146, 157
Junco, Oregon..... 145
Rocky Mountain..... 146

KILDEER..... 133
Kingbird ..... 140
Arkansas ..... 140
Kingfisher, Belted..... 136
Kinglet, Ruby-crowned..... 154
Western Golden-crowned.... 153
Kite, Mississippi..... 322
White-tailed..... 322

LANIUS borealis.....149, 157
Lark, Dusky Horned..... 141
Western Meadow..... 143
Larus brachyrhynchus.....130, 155
californicus.....130, 155
franklini ..... .. .....319, 327
glaucescens .....130, 155
heermanni.....130, 155
occidentalis.....130, 155
philadelphia .....130, 155
Leptomaria simplex..... 389
Lepus americanus washingtoni... 168
aquaticus.....190, 191, 194
cinerascens.....159, 308
gabbi..... 216
insolitus ..... 189
palustris.....190, 192, 194
sylvaticus..... 160
" aztecus.....188, 191
" floridanus..... 160
truei ..... 192
veræ-crucis.....189, 191
Lichas champlainensis.....22, 26
Lima rigida..... 384
tenuitesta.....384, 390
Lingulodiscina exilis..... 122
Lithodomus stamineus..... 384
Lituites convolvans..... 26
eatoni .....7, 16, 17
internastriata..... ... 16
seelyi..... 17
Loon ..... 129
Lophodytes cucullatus..130, 155, 328
Loxia curvirostra minor.....143, 157
Lucina crebrilineata.....384, 385
percancellata .....385, 403
safedensis..... 385
Lutra californica ..... 254
canadensis ..... 252
felina..... 254
Lynx rufus maculatus..... 219

MACLUREA acuminata.....16, 32
affinis.....6, 16, 17
magna .....4, 7, 25, 27
Macrocolus halticus.....272, 274

PAGE
Macrorhamphus scolopaceus, 132, 156
Macrotus boucourtianus.....179, 180
bulleri..... 179
californicus.....179, 180
mexicanus.....179, 180
waterhousei.....170, 180
Mactra didonis..... 386
olivensis.....386, 412
perventus..... 386
Magpie, American..... 141
Mallard..... 130
Mangelia ? solitaria.....387, 415
Megascops asio..... 127
" kennicotti..... 127
Melanerpes carolinensis..... 328
torquatus..... 139, 156
Meleagris gallopavo..... 321
Melospiza fasciata guttata...128, 147
" rufina..... 128
lincolni..... 147
" striata..... 148
Mephitis estor..... 258
macroura..... 258
mephitica.....161, 258
occidentalis..... 258
varians..... 260
Merula migratoria propinqua, 155, 158
Mesalia abeihensis..... 387
gazellensis.....387, 424
kokeni..... 387
Milvulus forficatus..... 318
Mimus modulator..... 342
triurus..... 342
Moineau de Cayenne..... 370
Molossus californicus.....195, 198
obscurus..... 169
perotis.....195, 198
Molothrus ater obscurus..... 328
Monodonta antiqua.....389, 434
Murchisonia confusa.....7, 20
obelisca..... 16
Murrelet, Marbled..... 130
Mus agrarius..... 297
" americanus, 295, 296, 297
alexandrinus..... 186
leucopus..... 297

PAGE
Mus musculus.....186, 223, 390
rattus..... 186
Musculus leucopus.....292, 296
Mycetes palliatus..... 204
Myiarchus crinitus..... 318
Myiothera ardesiaca..... 199
Myrmonax ardesiaca..... 199
myiotherinus..... 199

NATALUS micropus..... 169
Natica extensa..... 437
? indurata..... 387
olivæ.....389, 436
orientalis..... 387
patuliformis..... 387
scalaris.....387, 420
Natica ? (Amauropsis) scalaris... 420
Natica (Ampullina) fluctuoides... 417
" minima..... 418
(Gyrodes) orientalis..... .. 417
Naticopsis ornata..... 387
Nautilus kelloggi..... 17
Nemosia guira..... 361
pileata..... 361
Neotoma cinerea..... 167
" occidentalis.... 287
ferruginea..... 186
floridana..... 282
" mexicana..... 223
micropus.....224, 282
" canescens..... 285
Nerinea abbreviata.....389, 426, 437
berytensis..... 426
bhamdunensis.....388, 426
cochleariformis.....388, 426
cretacea.....388, 426
fleuriausa.....388, 426
gammifera..... 388
gimmifera..... 426
mamillæ..... 426
mammillæ..... 388
minima.....388, 415, 426
nobilis.....388, 427
orientalis.....388, 426
plauxilla.....388, 426
prælonga..... 438

PAGE
Nerinea schicki .....388, 426, 427
syriaca.....388, 426
Nerita abeihensis .....388, 431
bidens .....388, 431
pagoda..... 432
pogoda..... 388
Neritopsis ornata ..... 388
Neverita patula.....387, 419
Nighthawk..... 140
Noctilio mastivus..... 169
Notogoneus osculus..... 117
Nucula abrupta.....385, 399
crebrilineata .....384, 385, 396
glanstriticea.....385, 396
mauritiana..... 384
?obtenta..... 384
perobliqua.....385, 396
submucronata ..... 385
Nutcracker, Clarke's..... 143
Nuthatch, Pigmy..... 153
Red-breasted..... 153
Slender-billed ..... 157
Nyctea nyctea.....136, 156
Nyctinomus brasiliensis..... 178

OBELISCUS bilineatus.....388, 425
Ochetodon mexicanus. ..... 223
Odostomopsis abeihensis....388, 425
Olor columbianus.....131, 156
Ophileta complanata.....
4, 6, 7, 10, 27, 28
Opis megambona.....385, 398
obruta.....385, 399, 400
undata.....385, 399, 400
undulata..... ..... 400
Oreortyx pictus..... 133
Oriole, Bullock's..... 143
Oriolus melaleucus..... 359
Oriostoma dispar..... 30
Oroscoptes montanus..... 328
Orthoceras bilineatum....16, 26, 35
brainerdi ..... 16
explorator..... 33
moniliforme..... 26
multicameratum ..... 26
primigenium ..... 6

PAGE
Orthoceras titan..... 26
sordidam..... 34
Oryzoborus maximiliani..... 368
torridus..... 368
Oryzomys aquaticus..... 289
couesi .....187, 390
palustris .....224, 390
Osprey, American..... 136
Ostinops decumanus..... 376
Ostræa alicula..... 384
succini..... 384
(Exogyra) dieneri..... 384
" menneti..... 384
Otocoris alpestris leucolæma..... 127
" merrilli, 127, 141, 157
" strigata..... 127
Owl, Burrowing..... 323
California Pigmy..... 136
Great Horned..... 317
Short-eared ..... 136
Snowy..... 136
Western Horned..... 136

PAISANO del Monte..... 316
Pandion haliaëtus carolinensis...
136, 156, 328
Panopea didonis..... 386
pectorosa ..... 386
Parabuteo unicinctus harrisi..322, 327
Paraque ..... 317
Paroaria capitata..... 369
cervicalis ..... 370
gularis..... 370
Partridge, Mountain..... 133
Parus atricapillus occidentalis....
128, 153, 158
atricapillus septentrionalis...
128, 153, 158
atricristatus ..... 327
bicolor texensis..... 327
gambeli .....153, 158
hudsonicus..... 128
rufescens.....128, 153, 158
Passer cristatus..... 370
Passerella iliaca..... 128
" unalaschensis....
128, 148, 157

PAGE

Passerina amœna.....148, 157
ciris..... 318
cyanea..... 318
Pecten obrutus..... 384
Pectunculus sp.?..... 384
Pediocætes phasianellus..... 129
" columbianus, 129, 134, 156
Pelecanus californicus..... 130
Pelican, Brown..... 317
California Brown..... 130
White..... 317
Perisoreus canadensis..... 128
" capitalis.... 128
" fumifrons... 128
obscurus..... 128
Perna orientalis..... 384
palestina.....384, 394
Perognathus femoralis..... 281
flavus..... 225
hispidus..... 225
paradoxus spilotus..... 225
Petrochelidon lunifrons..... 149, 157, 318, 328
Peucæa cassini..... 328
Pewee, Western Wood..... 141
Phalacrocorax pelagicus robustus. 130, 155
Phalarope, Red..... 132
Phasianella abeihensis.....388, 425
Phasionella abeihensis..... 437
Philine (Megistolostoma) patula.. 387, 434
Phœbe, Say's..... 140
Pholadomya decisa..... 386
depacta..... 386
ligeriensis..... 394
Phonipara fuliginosa..... 369
Phytopsis tubulosum..... 22
Pica pica hudsonica.....141, 156
Picicorvus columbianus.....143, 156
Picoides arcticus.....139, 156
Pileolus sphærulitum..... 389
Pipit, American..... 151
Pipilo maculatus megalonyx..... 128, 148, 157, 328

PAGE

Pipilo oregonus.....128, 148, 157
Pipræidea melanonota..... 351
Piranga ludoviciana.....148, 157
rubra..... 318
saira..... 357
Plagiodontia œdium.....329, 336
Plagiostoma sp.?..... 384
Platopis abrupta..... 385
obruta.....385, 400
plicata.....385, 400
? triungularis.....385, 400
undata.....385, 400
Platyrhynchus bifasciatus..... 339
Plecotus (Corinorhinus) townsendi 176
Pleurotomaria difficilis..... 33
Plover, Wilson's.....317, 321
Polioptila boliviana..... 342
dumicola..... 342
Poocætes gramineus...129, 143, 157
confinis..... 129
Poospiza cinerea..... 372
Porphyriospiza cærulescens..... 371
Porzana carolina.....131, 156, 327
Potamides distortus.....387, 429
Primitia seelyi..... 20
Procnias viridis..... 349
Procyon lotor hernandezii..... 204
Progne domestica..... 346
tapera..... 346
Protocardium moabitia..... 404
Protocatostomus constablei..... 120
Psaltriparus minimus..... 128
Pteronotus davyi..... 178
Pterinoperna syriaca.....384, 393
Putorius arizonensis..... 234
brasilianus frenatus, 176, 219, 235
" xanthognathus... 235
cicognani..... 235
erminea..... 235
longicauda..... 235
nigripes..... 235
vison.....161, 235
Pyramidella amœna.....388, 425
Pyrocephalus rubineus mexicanus, 323

RADULA naamanensis.....384, 390

PAGE
Rail, King..... 320
Rallus elegans.....320, 327
Ramphocœlus atrosericeus..... 356
Recurvirostra americana..... 321
Red-head..... 131
Redstart..... 151
Regulus calendula.....154, 158
satrapa..... 128
" olivaceus..128, 153, 158
Rhaphistoma hortensia..... 32
Rhopocichla ardesiaca..... 199
Rhynchonella plena.....20, 22
Robin, Western..... 155
Rostellaria (Archura) rustemi.... 387

SACCOPTERYX plicata..... 178
Salpinctes obsoletus....129, 152, 158
Saltator atricollis..... 366
magnus..... 364
maximus..... 364
similis..... 365
Sandpiper, Bartram's.....317, 321
Cinnamon Solitary..... 132
Least..... 132
Pectoral..... 317
Red-backed..... 132
Semipalmated.....132, 321
Spotted..... 133
Western.....132, 321
Sapsucker, Red-breasted..... 139
Red-naped..... 139
Sao? lamottensis.....22, 26
Sayornis saya.....140, 156
Scalaria bewertensis.....387, 421
novemvaricosa.....387, 422
Scalops argentatus texanus..... 221
Scambula perplana..... 402
secunda.....385, 402
Schistochlamys atra..... 367
Scolecophagus cyanocephalus...
143, 157
Scolithus minutus..... 2
Scoter, Surf..... 131
Sciurus æstuans hoffmanni..... 206
alstoni..... 185
arizonensis..... 222

PAGE
Sciurus aureogaster....181, 182, 222
" leucops.....183, 185
cervicalis.....183, 185
deppei..... 222
hudsonius..... 41
" californicus.....
165, 166, 307
" douglassi.....162, 166
" fremonti.....162, 166
" richardsoni..... 162
" vancouverensis... 16
hypopyrrhus.....206, 222
leucops..... 182
mollipilosus.....165, 166
nayaritensis..... 185
striatus..... 71
" asiaticus..... 71
uthensis..... 71
variegatus.....181, 182
Seiurus aurocapillus.....318, 328
noveboracensis notabilis, 151, 158
Setophaga ruticilla.....151, 158, 318
Shrike, Northern..... 149
Sialia arctica..... 155
mexicana.....155, 158
Sigmodon arizonæ.....207, 208
berlandieri..... 287
fulviventer.....187, 207
hispidus.....207, 208
" berlandieri.....
186, 207, 224, 287
" littoralis.....207, 208
" texianus..... 287
" toltecus.....207, 208
Siskin, Pine..... 143
Sitta canadensis.....153, 158
carolinensis aculeata....153, 158
pygmæa.....153, 158
Skimmer, Black..... 317
Snipe, Wilson's..... 132
Sora..... 131
Sorex suckleyi..... 162
Sparrow, Golden-crowned..... 145
Intermediate..... 145
Leconte's..... 323
Lincoln's..... 147

PAGE

Sparrow, Rusty Song ..... 147
Sandwich..... 145
Texas ..... 326
Townsend's..... 148
Vesper ..... 143
Western Chipping..... 145
Western Savanna..... 144
Spatula clypeata..... 320
Speotyto cunicularia hypogæa...
323, 328
Spermophilus annulatus..... 186
grammurus..... 223
" macrourus..... 185
mexicanus ..... 223
spilosoma..... 185
tridecemlineatus ..... 223
Sphyrapicus ruber.....128, 139, 156
varius ..... 328
" nuchalis.....139, 156
Spilogale gracilis..... 258
indianola .....219, 308
phenax ..... 256
" arizonæ..... 256
ringens..... 310
Spinus pinus.....143, 157
yarrelli ..... 375
Spiza americana.....318, 326, 328
Spizella socialis.....129, 328
" arizonæ, 129, 145, 157
Spoonbill, Roseate..... 320
Sporophila cærulescens..... 368
gutturalis ..... 369
hypoleuca..... 368
lineola..... 369
melanocephala ..... 368
plumbea ..... 368
Squirrel, Ground..... 45
Red ..... 41
Stelgidopteryx serripennis.....
149, 157, 326, 328
Sterna fuliginosa..... 328
sandvicensis acuflavida..... 328
Strix pratincola ..... 328
Stromatocerium rugosum..... 27
Strombus? crassaliratus..... 416
mermeti ..... ..387, 416

PAGE

Strombus? (Melo) pervetus..... 387
Sturnella magna neglecta....143, 157
Sturnira lilium..... 181
Sublegatus virescens..... 339
Swallow, Barn..... 149
Cliff..... 149
Rough-winged.....149, 326
Tree..... 149
Violet-green ..... 149
Swan, Whistling..... 131
Sycalis arvensis..... 375
pelzelni ..... 375
Synetheres mexicanus..... 216
Sylvania mitrata..... 318, 328
pusilla ..... 128
" pileolata....128, 151, 158

TACHYCINETA bicolor.....149, 157
thalassina..... .. 149, 157
Tachyphonus melaleucus..... 359
rufus..... 359
Tamias amœnus.....
56, 61, 65, 66, 67, 90
asiaticus, 45, 46, 62, 64, 66, 71
" borealis....46, 71, 107
" bulleri .....47, 186
" dorsalis .....
47, 49, 50, 51, 68
" hindsii.....47, 75
" merriami.....47, 84
" pallasi..... 107
" pallidus ....46, 56, 110
" quadrivittatus .....
46, 80, 101, 106
" townsendii..47, 72, 75
bulleri.....
55, 60, 65, 66, 67, 92, 186
cinereicollis .....
55, 60, 65, 66, 67, 94
cooperi .....72, 74
dorsalis..55, 59, 64, 66, 97, 68
frater ...56, 60, 65, 66, 67, 88
hindei ..... 75
hindsii .....49, 55, 75
macrorhabdotes .....
51, 52, 55, 61, 64, 66, 67, 78

PAGE

Tamias merriami.....
50, 55, 60, 64, 66, 67, 84
minimus, 56, 58, 65, 66, 67, 110
" consobrinus.....
56, 59, 65, 66, 67, 112
minimus pictus.....
56, 59, 65, 66, 67, 115
obscurus.....
52, 55, 60, 64, 66, 67, 70
pallasi..... 71
quadrimaculatus.....
55, 61, 64, 66, 67, 80, 82
quadrivittatus.....
55, 57, 65, 66, 88, 97, 106
quadrivittatus affinis.....
56, 57, 65, 66, 67, 103, 167
quadrivittatus borealis.....
56, 65, 66, 67
" dorsalis..... 68
" gracilis.....
56, 58, 65, 66, 67, 99
quadrivittatus luteiventris...
56, 57, 65, 66, 67, 101
quadrivittatus neglectus.....
56, 57, 65, 66, 106
" pallasi..... 71
' pallidus.....
68, 110, 112
" townsendi.... 72
senex...55, 61, 64, 66, 67, 83
speciosus, 56, 60, 65, 66, 67, 86
townsendi.....55, 62, 64, 66,
67, 72, 75, 82, 167
" hindsii, 61, 64, 66, 67
umbrinus, 55, 58, 65, 66, 67, 69
striatus..... 229
" griseus..... 281
" lysteri..... 229
Tanagra cærulescens..... 371
cyanoptera..... 354
graminea..... 373
magna..... 364
maxima..... 364
palmarum..... 355
ruficollis..... 373
sayaca..... 354

PAGE

Tanager, Louisiana..... 148
Tancredia abeihensis..... 385
Tangara albirostris..... 359
des grands Bois de Cayenne.. 364
noir, d'Amerique..... 359
rufa..... 359
Tangaroux de Cayenne..... 359
Tatusia novemcincta...190, 217, 227
Taxidea americana.....239, 242
" berlandieri...239
" neglecta..246, 250
Teal, Green-winged..... 131
Tellina syriaca..... 386
Tern, Caspian..... 317
Forster's..... 317
Gull-billed..... 317
Royal..... 317
Thlypopsis sordida..... 361
Thomomys talpoides douglassi... 168
Thrasher, Texan..... 316
Thrush, Dwarf Hermit..... 154
Russet-backed..... 154
Varied..... 155
Willow..... 154
Thryophilus galbraithi..... 343
leucotis..... 343
Thryothorus bewickii spilurus..
152, 158
genibarbis..... 343
ludovicianus.....327, 328
Tiaris ornata..... 372
Titmouse, Black-crested..... 327
Texan Tufted..... 327
Tornatella abeihensis.....389, 437
Totanus flavipes.....132, 156, 327
melanoleucus..... 327
solitarius.....318, 327
" cinnamomeus..132, 156
Towhee, Oregon..... 148
Spurred..... 148
Trapezium naamanensis.....386, 406
Trigonarca palestina.....384, 395
Trigonia cuneata..... 385
cuneiformis..... 397
lewisi..... 385
pseudocrenulata.....385, 397

PAGE

Trigonia regularicostata ..... 397
syriaca.....385, 396
undulatocostata.....385, 397
Tringa alpina pacifica..132, 156, 327
canutus ..... 327
maculata ..... 327
minutilla .....132, 156, 327
Triptycha abbreviata..... 438
Trochilus rufus.....128, 140, 156
Trochus striætofundus.....389, 433
(Turcica) crispus..... 389
Troglodytes aëdon parkmani, 152, 158
hyemalis ..... 128
" pacificus..128, 152, 158
musculus ..... 343
Tryblidium conicum..... 29
Tubulostium rugosum.....387, 424
Turbo moreli..... 389
Turdus albicollis..... 340
albiventer..... 341
aonalaschkæ .....128, 154, 158
" anduboni..... 128
fuscescens ..... 340
" salicicolus, 154, 158, 340
ustulatus .....128, 154, 158
" auduboni..... 128
Turkey, Wild ..... 321
Turritella betmerensis..... 387
damesi ..... 387
magnicostata.....388, 417, 427
peralveata.....387, 422
seetzeni.....387, 423
syriaca ..... 387
ventricosa..... 423
Tylostoma birdana.....389, 438
depressa..... 389
gazellensis.....389, 438, 439
gradata.....389, 438
indurata .....389, 438
martini .....389, 438, 439
syriaca .....389, 438
triplica.....389, 438
Tympanotus orientalis..... 388
Tyrannus tyrannus.....
129, 140, 156, 318, 328
verticalis.....140, 156

PAGE

URINATOR imber..... 129
Urocyon virginianus..... 236
" scottii..... 236
Uroleuca cyanoleuca..... 380
Ursus americanus..... 161

VANIKORA neritopsoides..... 388
Veleda elliptica.....386, 406
Venus forgemolli..... 386
Vertagus coloratus.....388, 429
Vesperimus americanus..... 297
" nebracensis, 303
" rufinus..... 305
" sonoriensis..
224, 302
" texanus, 224, 304
californicus ..... 300
difficilis ..... 298
mearnsi..... 300
megalotis ..... 299
melanophrys ..... 299
nasutus ..... 299
nudipes..... 297
truei ..... 300
Vespertilio lucifugus..... 177
melanorhinus ..... 178
nitidus .....161, 177
perspicillatus..... 172
velifer..... 177
Vesperugo fuscus.....161, 169
georgianus..... 221
hesperus..... 221
Vesperus fuscus..... 204
Vireo belli.....318, 327
chivi ..... 345
gilvus .....150, 157
noveboracensis ..... 328
olivaceus.....
129, 149, 157, 318, 346
solitarius cassini.....150, 157
Vireo, Bell's ..... 327
Cassin's..... 150
Red-eyed ..... 149
Warbling ..... 150
Vola quinquecostata..... 384
Volatinia jacarini..... 369

PAGE
Volutomorpha ? orientalis...387, 414
Vulpes macrotis.....197, 238
velox ..... 238

WARBLER, Audubon's..... 150
Black-throated Gray..... 151
Lutescent..... 150
Macgillivray's..... 151
Myrtle ..... 150
Orange-crowned ..... 150
Pileolated ..... 151
Townsend's..... 151
Yellow ..... 150
Water-thrush, Grinnell's..... 151
Waxwing, Cedar..... 149
Willet..... 317
Woodpecker, Arctic Three-toed.. 139
Batchelder's ..... 138
Gairdner's ..... 138
Harris's..... 137
Lewis's ..... 139
Northern Hairy..... 136
Pileated ..... 139
Wren, Baird's..... 316
Carolina ..... 327

PAGE
Wren, Long-billed Marsh...317, 327
Parkman's..... 152
Rock ..... 152
Short-billed .....317, 327
Tule ..... 152
Vigors's..... 152
Western Winter..... 152

XANTHOCEPHALUS xanthocephalus..... 318
Xiphocolaptes major castaneus... 339
Xiphorhynchus rufodorsalis..... 339

YELLOW-LEG, Greater..... 317
Lesser..... 317

ZAPUS hudsonius..... 168
Zenaidura macroura.....134, 156
Zonotrichia capensis.....372, 373
chilensis..... 373
costaricensis..... 374
coronata .....145, 157
leucophrys intermedia...145, 157
pileata..... 373
subtorquata ..... 374

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ARTICLE VIII.—*Descriptions of a New Species and a New Subspecies of the Genus Lepus.* By J. A. ALLEN.

ARTICLE IX.—*List of Mammals collected by Mr. Clark P. Streator in British Columbia, with Descriptions of two New Subspecies of Sciurus.* By J. A. ALLEN.

ARTICLE X.—*Notes on a Small Collection of West Indian Bats, with Description of an apparently New Species.* By J. A. ALLEN.

ARTICLE XI.—*Notes on Collections of Mammals made in Central and Southern Mexico, by Dr. Audley C. Buller, with Descriptions of New Species of the Genera Vespertilio, Sciurus, and Lepus.* By J. A. ALLEN.


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ARTICLE XVI.—*Description of a New Subspecies of the Eastern Chipmunk, from the Upper Mississippi Region, West of the Great Lakes.* By EDGAR A. MEARNS, Assistant Surgeon, U. S. A.

ARTICLE XVII.—*Description of a New Species of Weasel, and a New Subspecies of the Gray Fox, from Arizona.* By EDGAR A. MEARNS, Assistant Surgeon, U. S. A.

ARTICLE XVIII.—*Observations on the North American Badgers, with Especial Reference to the Forms found in Arizona, with Description of a New Subspecies from Northern California.* By EDGAR A. MEARNS, Assistant Surgeon, U. S. A.

ARTICLE XIX.—*Notes on the Otter (Lutra canadensis) and Skunks (Genera Spilogale and Mephitis) of Arizona.* By EDGAR A. MEARNS, Assistant Surgeon, U. S. A.

ARTICLE XX.—*Notes on New or Little-known North American Mammals, based on recent additions to the Collection of Mammals in the American Museum of Natural History.* By J. A. ALLEN.

ARTICLE XXI.—*On the Color-Pattern of the Upper Tail-Coverts in Colaptes auratus.* By FRANK M. CHAPMAN.

ARTICLE XXII.—*On the Birds observed near Corpus Christi, Texas, during parts of March and April, 1891.* By FRANK M. CHAPMAN.

ARTICLE XXIII.—*Description of a New Species of Capromys, from the Plana Keys, Bahamas.* By J. A. ALLEN.

ARTICLE XXIV.—*On a Collection of Birds from Chapada, Matto Grosso, Brazil, made by Mr. Herbert H. Smith.* By J. A. ALLEN. Part I.—OSCINES.

ARTICLE XXV.—*Observations on some Cretaceous Fossils from the Beyrût District of Syria, in the Collection of the American Museum of Natural History, with Descriptions of some New Species.* By R. P. WHITFIELD.

CONTENTS AND INDEX TO VOLUME III.


---

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